ARCHITECTURAL DRAWING

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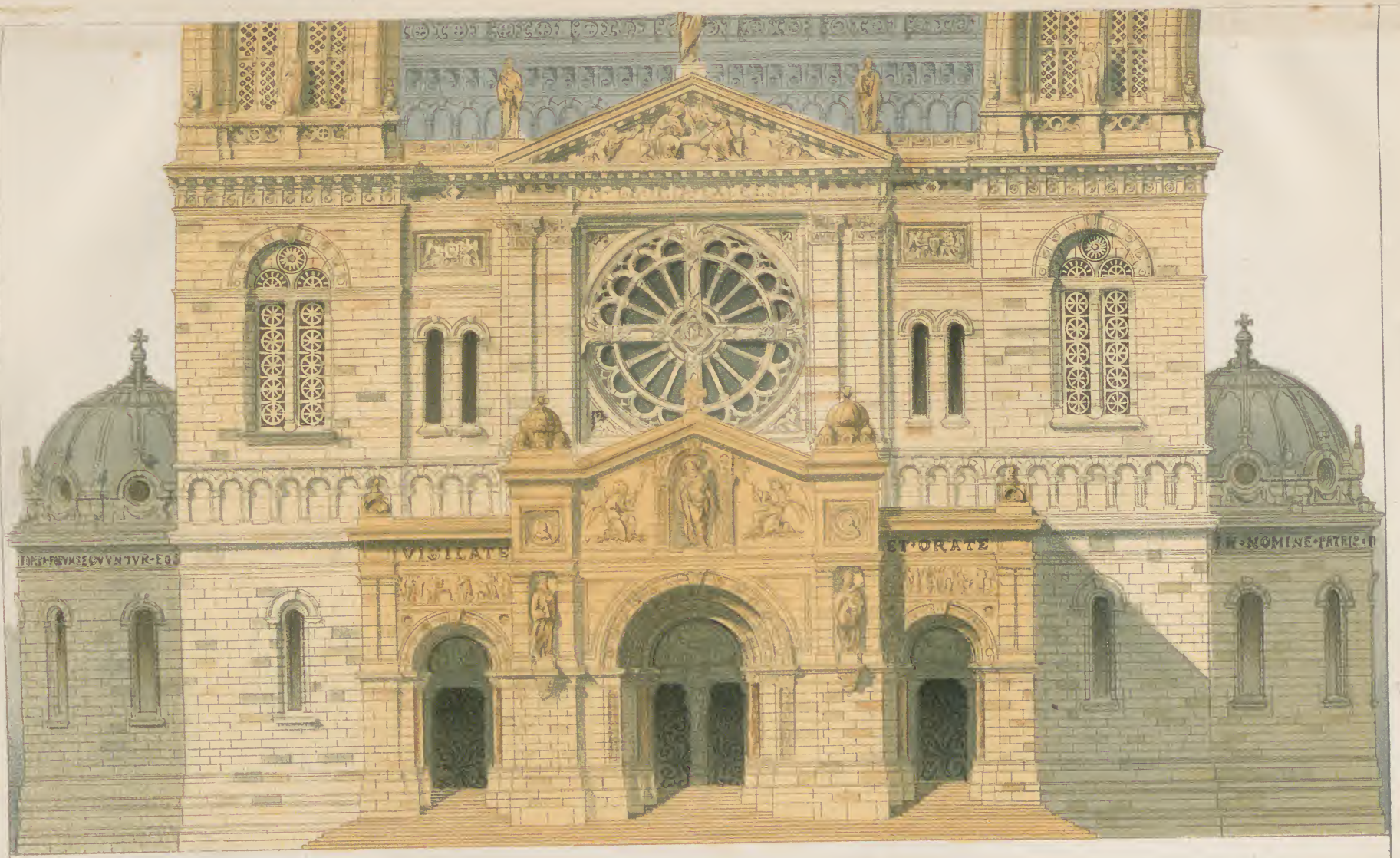

STUDY FOR CHURCH.

R. Phené Spiers. F.S.A.

ARCHITECTURAL DRAWING.

BY

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PREFACE.

This book is the outcome of a paper read by the author at a meeting of the Architectural Association in 1874. Intended at first to throw out a few suggestions on the various types of architectural drawing at the present day, and more especially on that variety of shaded drawing which is practised in foreign schools: its scope has been extended in this work to include preliminary training in all kinds of architectural draughtsmanship, with special reference to artistic design. With this object the author has endeavoured to place himself in relation with the requirements of English office-training at the present day: and to point out how, concurrently with office work, the architectural pupil may turn to the best account the ever-increasing opportunities for private study.

In the second part of the book the author has ventured to lay down a series of rules for the preparation of working drawings, which are, as far as he has been able to ascertain, in accordance with the customs which obtain in many of the principal London offices. Various books have appeared from time to time in England and on the Continent, giving plans, elevations, and sections of buildings or parts of buildings and structures illustrated in colour; but this is the first occasion, the author believes, in which an attempt has been made to reproduce the best type of working drawings of the present day, with all the various colours which are employed to indicate the several materials employed. There is, of course, some little diversity of custom; and the use of Carmine for brick walls, Prussian-blue for stonework, and Indian-yellow for wood floors, is still adhered-to in some offices; more importance, apparently, being attached to the strong contrast which these colours give than to the harmony which should, if possible, exist in the general effect of even a working drawing. At first sight it might appear to be a matter of little moment what colours are employed, provided they have the great important result of distinguishing the materials, and are recognised or understood by the workmen; there is, however, this danger, that if the eye of the pupil or draughtsman be constantly fixed on drawings crude in their colour and inharmonious in their contrast, it may tend to a mischievous result; and his perception of a true sense of colour may be at fault if in his subsequent life he is called upon to design and superintend the colour-decoration of a building. It may here

be noted that in the printing of Plates 7, 8, and 9, it has not been found possible to obtain quite the same tone as that of the ordinary water-colour cakes used in English offices.

In the third part of the book—on Outdoor Work—the author has brought together all the information which exists on the subject: from his own personal experience, from the advice of friends, and from a careful examination of drawings made by students during the last twenty-five years; and he desires here to express his obligations to Mr. W. H. Bidlake, M.A., for much useful information in the paragraph dealing with measured work; and to Mr. A. Oliver for his valuable experience in the rubbing of brasses.

The author desires also to express his obligation to Mr. H. H. Stannus for the useful suggestions he has received from him in the arrangement of the work, and for his valuable assistance; as also for that of his brother, Mr. Walter L. Spiers, in the revision of MS. and proofs. His special thanks are due to Mrs. Cockerell for the valuable illustrations which he has been permitted to publish of the drawings by her husband—the late Mr. Frederick Pepys Cockerell; and to Mr. R. Norman Shaw, R.A.; Mr. J. L. Pearson, R.A.; Mr. Alfred Waterhouse, R.A.; and to other contributors whose drawings have been so kindly lent to him for the purposes of illustration.

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ARCHITECTURAL DRAWING.

INTRODUCTION.

The term "Architectural Drawing" is intended to include every kind of drawing which may have to be executed by an architect at any period of his career, whether for the purposes of elementary study, professional practice, or recreation.

The nature of these drawings being necessarily varied, some little difficulty presents itself at the commencement in deciding upon the order in which the different classes should be described. This difficulty would not arise were we dealing with the curriculum of architectural training abroad, owing to the existence in most countries of a complete and definite course, well established by long tradition, and under the direction of skilled masters.

In England the student is expected, almost as soon as he enters an office, to take his share and assist in making working drawings for a building to be executed, which should be, and is with other work, looked upon as the end and aim of all architectural study. Thus the thorough course of study in architectural drawing and design which is gone through in foreign schools must perforce, under the pupilage system in England, be attempted in a haphazard manner, having to be almost invariably undertaken by the pupil in his own leisure time after office hours, and being sometimes entirely neglected until the Articles are terminated.

Under these circumstances it has seemed to us that in our description what is essentially students' work should be separated from the ordinary work of the office, and accordingly the subject will be treated in three broad divisions, viz. :—

I. STUDENTS' WORK.
II. OFFICE WORK.
III. OUTDOOR WORK.

We are thus enabled to leave undecided the difficult questions—1stly, when and where the studies enumerated in Parts I. and III. should be undertaken; and, 2ndly, to what extent the pupil should carry further his study and practice in either of them.

The subject of Architectural Education and its further development to suit the needs of the time is gradually working its way to the front as the most important question with which the Profession has to deal; and such questions as we now leave undecided will eventually, it is to be hoped, by common consent and custom, be settled

one way or the other, to the advantage of Principal and Pupil, the Profession, and the Public.

As draughtsmanship and the method of execution depend to a certain extent on the quality of the paper and of the instruments used, some mention of them may be found of value.

DRAWING PAPER.

Whatman's "hot-pressed" and "not" (*i.e.*, not hot-pressed) papers are those generally used. The former is much the best, on account of its smooth surface, for line drawings, whether left in pencil or inked-in; but if many corrections are made, the surface is liable to be destroyed, the lines are apt to spread and become woolly, and colour lies in patches on it; further, it is not easy to colour on it, as it is non-absorbent. For beginners, therefore, or with drawings in which much erasure with rubber is likely to be required, as well as for all those drawings which it is intended to tint in flat or gradated colours, it is better to use Whatman's "not."*

Cartridge paper is frequently used on account of its less cost and of the large dimensions in which it is made, being obtainable sixty inches wide and in continuous rolls. Like hot-pressed paper, its surface will not allow of much rubbing out, but it takes colour fairly well, and is invaluable for large scale details. It gets brittle with age, and is apt to crack and tear. Thinner qualities and lining paper are occasionally employed for full-sized details and other drawings which are likely to be required only for a temporary purpose. Hudson and Kearns' "Loan Cartridge" is an excellent paper, of smooth surface, not easily torn, and sufficiently transparent to allow of thick line drawings and details being traced through it.

The ordinary tracing paper becomes brittle with age, and is therefore mounted on linen by the builder for use on the works. The quality known as "papier végétale" is less brittle, but does not lie so flat upon the drawing while the tracing is being made.

Tracing linen is best for contract work; the most useful is that which has only one surface glazed and the other surface left dead to receive the ink-line. Tracing linen will not take pencil, and ink must therefore be used. When a tint of colour is laid over the ink-lines, it washes them up; and all tinting except the sectional parts should be done on the reverse side to the ink outline, *i.e.*, on the glazed side.

Tracing linen is very sensitive to damp (and most building operations are damp at some time or other); care should be taken therefore that the drawings are not obliterated while on the works.

* For outline and working drawings it is the custom to fix the paper on the drawing board with drawing pins; when, however, especial care and accuracy are required, as in competition and show drawings, the paper should always be strained and mounted; in the case of drawings which it is intended to tint or colour, this becomes an absolute necessity, to prevent the cockling of the paper.

With tracing linen, as with tracing paper, it is necessary occasionally to mix oxgall with the ink, on account of a greasiness on the surface. The use of oxgall can, however, be obviated by rubbing powdered chalk or whiting over the surface of the tracing linen with a duster, which removes all grease.

DRAWING INSTRUMENTS.

The instruments required, though few in number, should be of the best quality; it is impossible to obtain the accuracy necessary in architectural drawings at the present day if the compasses and bows have legs of uneven length, or blunt points, or work stiffly in their joints. As these instruments, if well made, will last a lifetime, it is a mistake to begin, as some do, with inferior ones.

The instruments required for ordinary use are—

(*a*) Dividers: which are used for taking or noting down single dimensions, or for subdividing lines or spaces.

(*b*) Half-set compasses with ink and pencil points and lengthening bar.

(*c*) Pencil bows and ink bows (double-jointed): for smaller curves.

(*d*) Spring bows: which are occasionally required, but may, with the exception of the ink bow, be dispensed with.

(*e*) Ruling pens: of two or three degrees of fineness.

(*f*) Scales: in wood or ivory.

(*g*) Pencils: of various degrees of hardness to suit the quality of paper used.

(*h*) T squares: in pear or mahogany; the latter, with ebony edge, lasting the longest.

(*j*) Set squares: vulcanite being the best.

(*k*) Drawing boards, ebony edge, and clamped at back.

(*l*) Writing pens: for freehand work, Gillott's No. 303 is well adapted for the purpose.

(*m*) Drawing pins: the larger size are stronger, and less likely to be lost.

(*n*) Centres.*

* A difficulty is sometimes experienced, when a number of circles have to be drawn from the same centre, in obtaining sufficient accuracy, owing to the deep hole caused by the compass-point in the paper on the board; in such cases the smaller circles should be described first. It is possible, however, to obtain at the instrument-maker's small horn centres, about $\frac{3}{8}''$ in diameter, small pins underneath fastening them on the paper; the French students use small pieces of mouth-glue, which they cut off and stick on the paper where required.

Part I.

STUDENTS' WORK.

FIRST DIVISION.—DRAUGHTSMANSHIP.

Section A.—ELEMENTARY PROJECTION AND COPYING.

1. The first question to be considered is the nature of the drawing upon which the pupil should commence his work. His preliminary training, prior to entering the office, may in some degree modify its elementary nature; as a rule, however, even those boys who are supposed at school to have shown some taste for the profession which they have selected, have probably been allowed to draw with indifferent instruments, from inferior models, and with insufficient instruction, so far as drawing of architectural subjects is concerned. The pupils' work in any case, therefore, has to be commenced "de novo," and the first object will be to train the hand to the use of proper drawing instruments, and the eye to the geometrical forms, proportions, and detail which constitute the elements of architectural design.

2. Before this latter, however, some preliminary training in geometrical drawing, including the projection in plan and elevation of solids—such as cubes, cylinders, spheres, and other forms—will be found a distinct advantage in the case of those who have never attempted such subjects; it will materially assist in the proper understanding of the projections of some of the more elaborate classic orders with their ornament if the simpler forms, their projection, formation, and development, are learnt first.

3. The customary procedure at the present day is to set the pupil to copy some of the show drawings there may be in the office, or examples of the Classic orders, such as are published in Pugin's edition of Normand's Parallels; Chambers; Vignola; and Mauch.*

4. The reason why the Classic orders constitute the best models for beginners is, that the column and entablature of each order are constant in their proportions, without reference to its dimensions, its execution, or, necessarily, to its surroundings; they constitute, therefore, a better training for the eye, as regards the scale of the main

* "A New Parallel of the Orders of Architecture." By Charles Normand. Edited by Augustus Pugin. London, 1829. "A Treatise on Civil Architecture." By William Chambers. Revised by W. H. Leeds. London, 1862. "Le Vignola des Architectes." Par Charles Normand. Paris, 1842. "Architectonischen Ordnungen von T. M. V. Mauch." Berlin, 1855.

features and the relative proportions of the mouldings, than Gothic examples, where the dimension of each feature is ruled by its execution, its proportion and shape are subordinate to its position in the complete building, and the building itself is governed by its adjuncts and surroundings.

5. The simple copying of an architectural drawing is, by itself, of use only in the training of the hand, and leaves little impression on the memory; it has been our custom, therefore, to recommend two variations, which, as they form a starting-point for the "study of design," will be referred to in the second section of this division (par. 58).

SECTION B.—FREEHAND DRAWING FROM THE ROUND.

6. In former times, when a pupil was articled for seven years, it was the custom to set him to make drawings from plaster casts in the office; few offices now possess such casts, and it is necessary to go elsewhere to acquire a knowledge of freehand drawing from the round, the importance of which cannot be overvalued. Its special object is not only to train the hand, but to accustom the eye to a recognition of the varied forms which flowing ornament in relief takes, as seen in perspective.

7. The method by which the drawing is produced, whether by shading in pencil, ink, or chalk, sepia, or Indian ink, is of secondary consideration. The architectural student, however, in making these drawings, has, in one respect, more to do than the painter; the latter has only to copy exactly what he sees, with all the accidents of light and shade which there may be in the object he is copying; whereas the architect has to learn the forms, to inquire into their nature, and to recognise the effect of their shadows, in order that he may hereafter design similar features, and be able to represent them as a guide to the modeller or carver. If he *copies* only, he will probably reproduce in his drawing the dirt or dust which may be on the cast, and put dark patches when there should in reality be high lights.

8. Sometimes it is possible not only to represent the actual form of the ornament, but in the execution of the drawing to suggest the marks of the chisel, and an illustration of a drawing [Plate I.] of a capital from the cast executed in the schools of the Royal Academy suggests the marks which the chisel might have made in the carving.

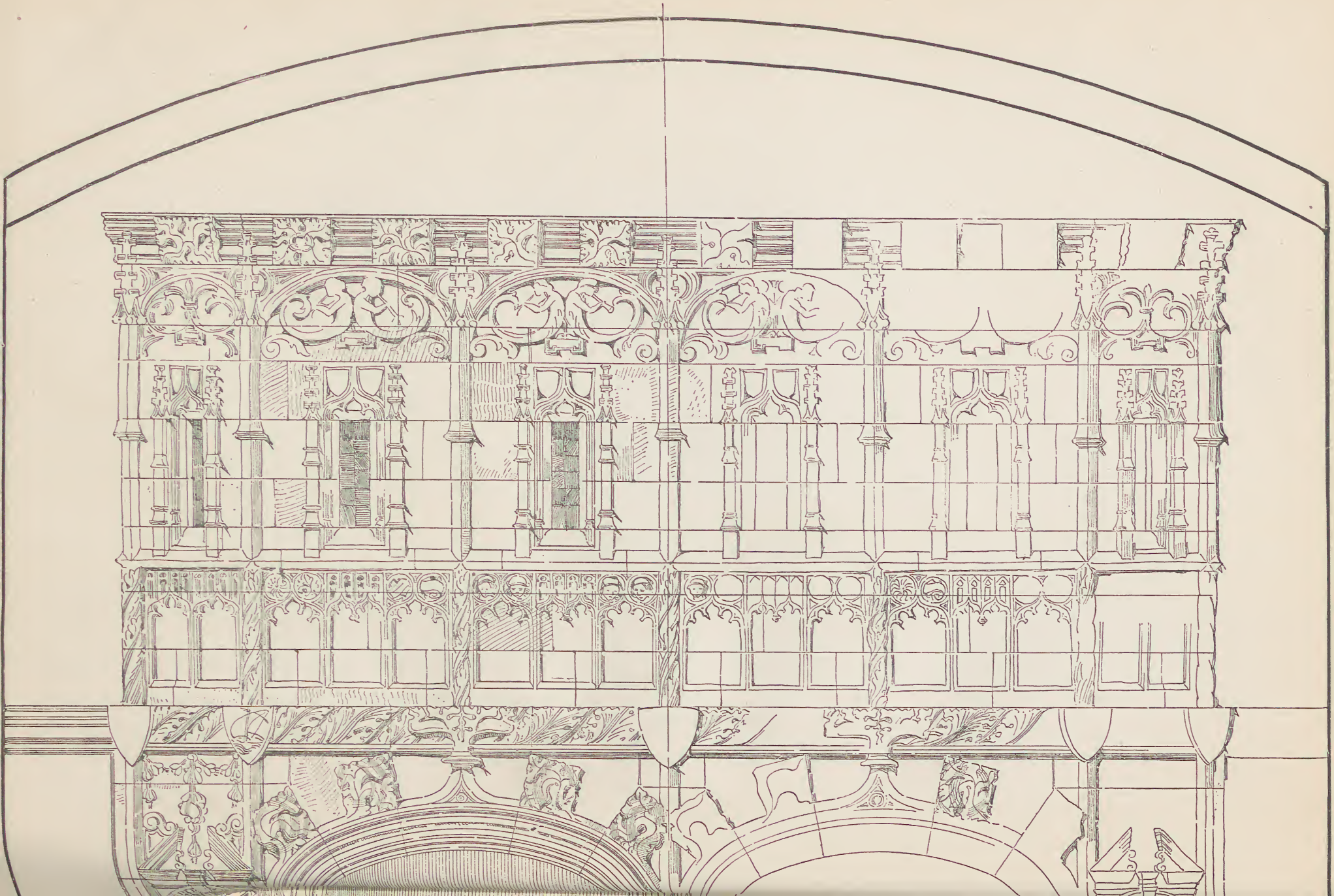
9. As it is generally the custom to have a model made when carving is of importance, it is not always necessary to make a full-size drawing; and the late M. Viollet-le-Duc (who had trained his carvers to understand his small scale drawings) prepared sketches of his sculptured ornament, about one-eighth full size, on tinted paper, shaded in Indian ink, and put in the high lights with Chinese white.*

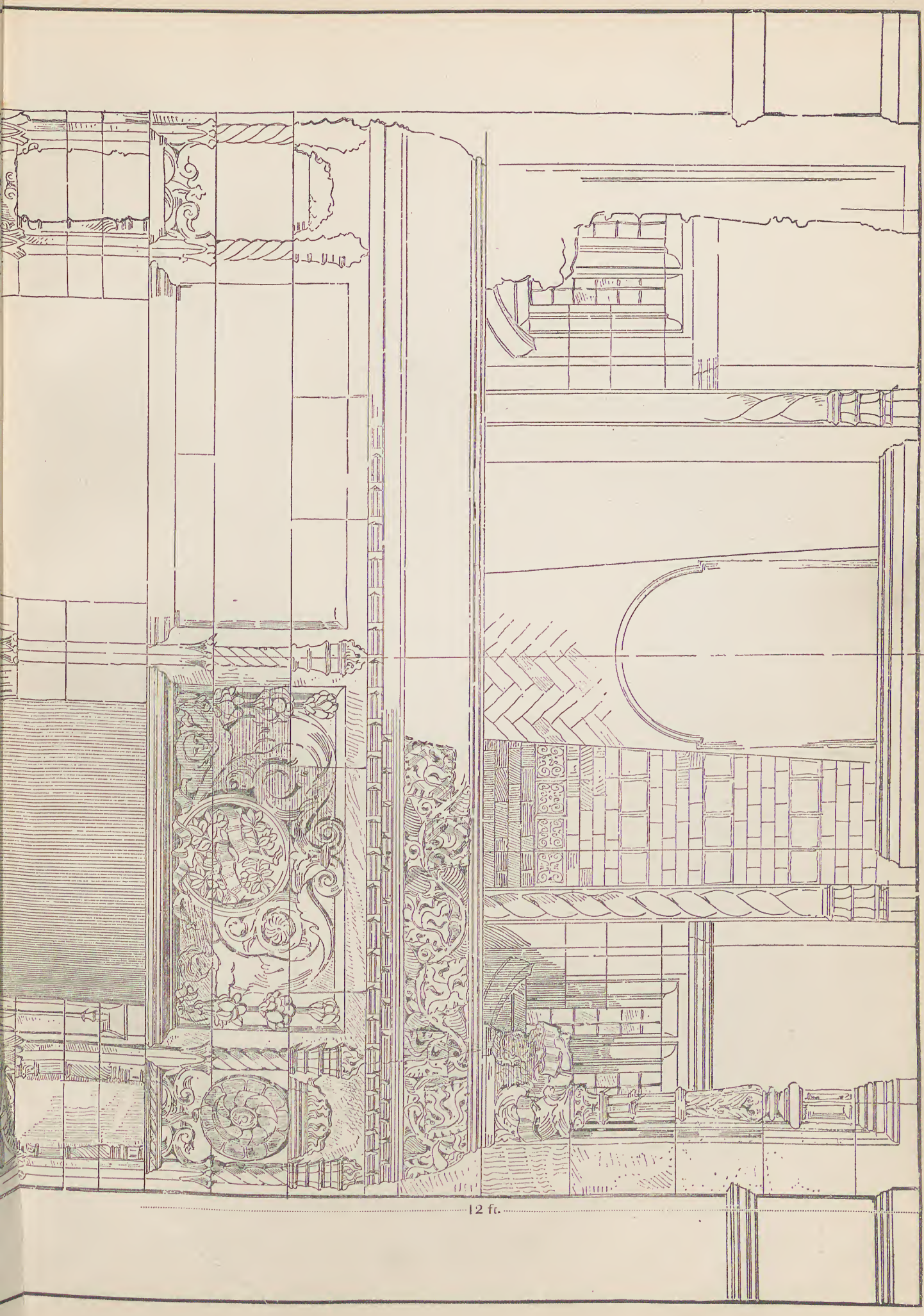
* Instruction in modelling and ornamentation for Architectural purposes has been established in the Architectural School of the Royal Academy under Mr. H. H. Stannus for the last five or six years; and this has been found to give a power of seizing the forms of and representing architectural ornament with a view to its conception and design.

FREEHAND DRAWING, SHADED.

From Cast in Royal Academy. H. Needham Wilson.

RULED AND FREEHAND LINE DRAWING.





R. Norman Shaw, R.A.

FIREPLACE, DAWPOOL, CHESHIRE

10. As a rule the students from the provinces seem to be better trained in freehand drawing than those in London; and in towns in which there is a School of Art, it is invariably the custom for the pupil to be sent there in the evening to learn both freehand drawing and shading.

11. Similar schools are to be found in London, but whether owing to the distances being too great, or to other causes, probably not more than one per cent. of the articled pupils here avail themselves of the opportunity of attending them. The large collection of casts at the Royal Architectural Museum in Tufton Street, of those in the Museum at South Kensington, and of the original marbles in the British Museum, offer the best models that can be found; and in the Architectural Museum it is easy to obtain instruction without passing through those preparatory stages which in the Schools of Art (formed for other purposes) are insisted on.*

Section C.—GEOMETRICAL DRAWINGS.

CLASS A.—OUTLINE DRAWING.

12. In the execution of geometrical drawings the line should always be firm, and of equal thickness throughout its whole length; every part of the line should be ruled with the T or set square, with the same care as if it were being drawn without the aid of either of these instruments. And in all cases the ruling-pen should be kept perpendicular or nearly so, and the nibs parallel to the edge of the square.

13. The thickness of the line varies with the scale of the drawing, and, sometimes, with the style of the work represented. A very thick line is sometimes to be condemned—because, as a rule, it is deceptive, and suggests more work in the design than will hereafter be found in the building. On the other hand, it necessitates much greater care in the drawing, and sometimes conventionalises the design which is represented, so that breadth and simplicity are the result.† A very thin line, on the contrary, sometimes leads to an attempt to introduce much more detail and ornament, and more elaboration of cornice and moulding, than the character of the design requires, or there is any occasion for.

14. Generally, Greek or Renaissance work requires a finer line than Gothic. On this subject, however, it is impossible to lay down any definite rule; and it must be left to the artistic feeling of the student to adopt that thickness or fineness of line

* For those students who desire to enter the Schools of the Royal Academy some preliminary test is required of their proficiency in drawing and shading from the round, but the method of execution is left to the applicant They are generally expected to be drawn the full size of the cast and shaded in pencil, ink, or chalk, sepia, or Indian ink.

† The late Mr. William Burges, in a paper read before the Royal Institute of British Architects in 1861, remarks: "If the draughtsman uses thick lines he will be induced to make his design massive and simple, and not give way to the vanities of crockets and pinnacles, because he will find that he has hardly got space to get them in."

which suits best his own design. It is also of advantage sometimes to draw, in freehand,* those lines of his design which he feels will have more force and individuality when drawn thus. These remarks naturally apply to almost every description of moulding (the profiles of which become hard and mechanical if turned in with the compass), and especially to cusping in Gothic work.†

15. The practice of backlining (which consisted in emphasising the under and right-hand side of any projecting feature with a line of double thickness, intended to suggest a shadow) is now happily almost gone out of fashion. It was apt to lead to slovenly drawing, because it enabled the student to correct his work afterwards, and draw attention from the irregular thickness of the lines already drawn; furthermore, it gave an incorrect idea of the ultimate effect of the building, because a projection of one inch would have its backline of the same thickness as one of several feet; and this, when carried through a drawing, became mechanical.

16. The same objection does not apply to the finish which may be given to a drawing, either in pencil or ink, where certain portions, such as the deeper recesses of undercut mouldings, or the accentuation of foliage and ornament, are emphasised by a few darker lines or points; and it certainly gives brilliance to a drawing if, instead of ruling in all the lines of a moulding, two or three only are carried through, the others being indicated only at their junctions with others, or where stopped short by another moulding.‡

17. The effect of high light (to use a painter's phrase) can be given in an outline drawing if the lines coming down on to the upper surfaces of projecting mouldings or ornament be stopped short before reaching them.

18. When a geometrical drawing represents a building with several planes, those in the background may be ruled in with ink of a lighter colour than those in the foreground, and this, as also the indication of the lines of jointing with thick lines, in light ink, adds to the artistic effect of a drawing, without in any way impairing its value as a truthful representation; in fact, rather the reverse.

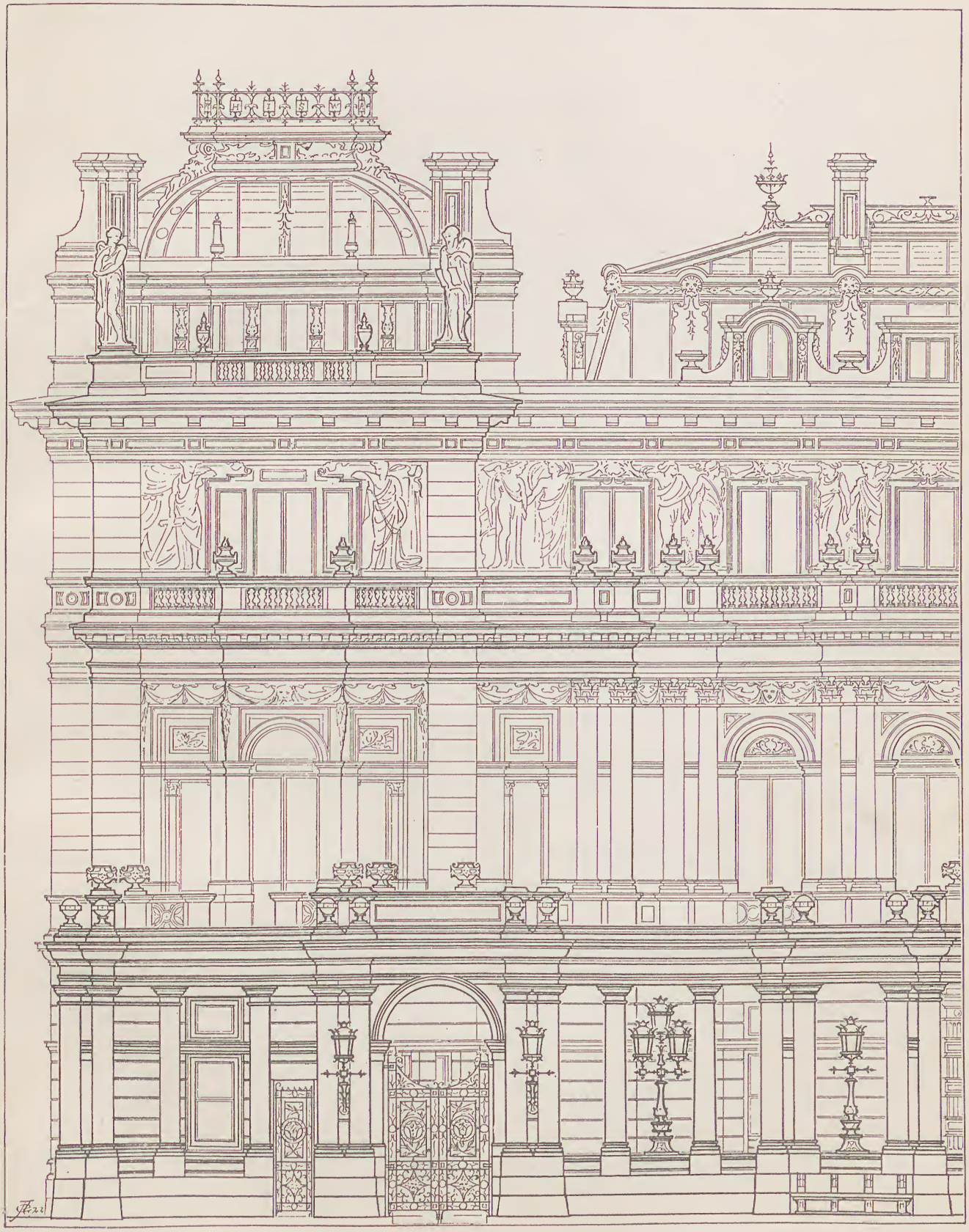
19. This system can sometimes be carried further by a process of contouring, which Mr. Stannus calls "mass-lining," and of which we publish an illustration [Plate 3]. It consists not only in inking-in the various plans of a building in lines of different

* See illustration of a design for a chimneypiece, by Mr. R. Norman Shaw, R.A., Plate 2.

† Professor Ware, whose experience of twenty years in the foundation and development of the Schools of Architecture in Boston and New York gives him some claim to attention, writes: "Another point of view I am in the habit of insisting on is that architectural drawing lies between mechanical and artistic draughtsmanship, partaking of the nature of both, but using a different intellectual method from either; I mean that an architect not only does a good deal of freehand work when working with his instruments in a way which an engineer would consider very unworkmanlike, but that he uses a great deal of geometry in his freehand work, in a way that an artist would find impossible. He employs, when sketching, the same intellectual processes as if he had in hand his compasses and set square, instead of pencil and brush, correcting and justifying his judgment by purely geometrical considerations. This seems to me to be the distinctly architectural habit, and I do everything I can to foster it."

‡ The late Mr. George Edmund Street's drawings of the New Law Courts, and Mr. William Burges's drawings, are good illustrations of this treatment.

LINE DRAWING CONTOURED OR MASSED.



STUDY FOR TOWN MANSION. *H. H. Stannus, F.R.I.B.A.*

strength, but in emphasising the mass-lines of the foreground blocks; this has the effect of bringing out their mass, though not, of course, to the same extent as by the use of tinting.

20. The use of red, blue, and yellow lines, to indicate courses of brick of those colours, gives a relative value which (for $\frac{1}{2}''$ scale working drawings) may sometimes take the place of tinting, provided the full effect of the colour has been first ascertained on the $\frac{1}{8}''$ scale drawing.

CLASS B.—TINTED AND SHADED DRAWINGS.

21. We have hitherto confined our attention to line drawings, these being as a rule the chief class of work done by students. The custom of tinting geometrical drawings (which here in England seemed to go out of fashion with the Gothic revival) is apparently again coming in; and the methods of its execution should therefore be acquired.

22. The relative effect of an elevation is better explained when the windows are tinted or blacked-in, and the roof is coloured. Should the design include materials widely differing in colour, such as red brick and stone, it is quite impossible to judge of its real effect until the colours have been laid on the drawings.

23. In France and Germany it is the practice not only to indicate the materials by tints on the geometrical drawings, but to project the shadows cast at an angle of 45°, and to colour these with all the consequent half tones, high lights, and reflections, which necessarily follow; so that the whole design is brought out in relief, the object being to emphasise the mass, and to minimise the effect of the lines, which are drawn in to explain the general design and construction, and do not exist in the building itself. Long traditional use in foreign schools and "ateliers" has raised the execution of these drawings to a very high standard; in projecting the shadows, the principles of sciography are minutely adhered-to, great care is paid to the preparation of the tinting materials, and experience and ability are required in laying them on.

24. It is obvious that with a slight knowledge of geometry it would be possible to project shadows at any given angle, at 60° to 70° vertically on a South front, and at 20° to 40° on an East or West front; and, under some circumstances, the real effect of the building as a mass and in detail might be obtained. The actual lighting by the sun does not, however, govern the principle of projecting shadows at 45°, which is simply a conventional method of representing on one drawing that which it would otherwise take three at least to explain. The shadow is supposed to be cast by a light at an infinite distance (for convenience of projection on account of the parallelism of its rays), which is assumed to be behind the spectator in a plane situated both horizontally and vertically, at an angle of 45° to the front of the building. The depth of any shadow, therefore, either horizontal or vertical, will represent the distance of the line or point which casts the shadow from the plane on which the shadow is cast. The shadow cast vertically indicates the projection of a

cornice which otherwise could not have been ascertained without reference to a *section;* and that cast horizontally shows the projection of a column, a pilaster, or of a block of the building, which otherwise would have required a *plan* to explain it. The number of plans or sections which might be required at different levels, or through portions of any design in order to represent its variations, would depend on its importance and intricacy: it is sufficient here to dwell on the fact that, by a purely conventional process, it is possible in a single drawing to concentrate the effect of many.

25. The advantage of this is obvious; it is difficult sometimes in turning from one drawing to another to realise what the effect, as a whole, might be; and this is specially experienced when the projections are slight, as in the case of cornices and columns. In a shaded elevational drawing these are seen in juxtaposition, and their relative effect to the whole mass can be judged of with an exactness which no single perspective would show,* whilst its execution will take far less time. As a means of studying a design, it is invaluable; in fact, it is doubtful whether in some cases it is possible to do satisfactorily without it, except by a man of very distinct views who is able to conceive in his brain a clear conception of what he requires.

26. The system of projecting and tinting the shadows is further carried by the French students into the plans and sections, not, however, for the purposes of study, but as a means of artistic representation in the case of plans, and of showing the design in relief and colour in the case of sections. In plans the covered portions of the buildings are left white, and the courts and surrounding ground (if paved) tinted pale grey; on to these grey grounds a shadow, as it were, of a plinth, 2 ft. in height, is projected. The walls are always tinted jet black; statues, lamps, or balusters in section, are tinted vermilion, to distinguish them from columns. In gardens, isolated trees are indicated by small circles, as if they had been cut through the trunk, and short shadows are projected from them. Shrubberies are represented by washes of green, made with Indian yellow or other colours, and the French "ultramarine," which deposits freely and suggests foliage; the garden paths are tinted light burnt sienna, and grass is shown by flat washes of green.

27. The covered portions of the building are left white, but an indication is made of what might either be a parquet floor or the design for the ceiling, if it be a large room, suggesting the construction with beams and coffers; the richness of the design of this parquet floor suggests the relative importance of the apartment.

28. The section is invariably supposed to be taken through the centre of the chief rooms; by custom, therefore, a room which has a vertical shadow projected of 12 ft. deep is recognised as being 24 ft. long. It is usual to indicate the coloured decorations, however simple they may be, in every room: and in order not to interfere with the colour effect of this, all sectional parts are tinted a pale pink.

* There is no doubt that a properly tinted and shaded drawing is, like a language, unintelligible to those who are not acquainted with its technicalities, though easily read and understood by those who have studied and made use of it during their professional education.

STUDY FOR CHIMNEYPIECE.

The late Frederick Pepys Cockerell.

STUDY FOR FOUNTAIN.

The late Frederick Pepys Cockerell.

29. In tinting geometrical drawings it is the custom to gradate all the washes, whether on the walls, windows, or the shadows; this is done from the top to the bottom, probably suggested by the supposed brilliant reflection from the ground. Its actual result is to give lightness to the drawing and to suggest more finish; this is further obtained by the counter reflections, which give transparency to the shadows, and model the ornament and other features in shade.*

30. If the geometrical drawing represents a building in several planes, warmer tones are washed over the front portions, colder ones over those in the rear, the colour of the shadows changing in harmony with the tone. In monochrome drawings, the distancing is generally effected by the shadows in the projecting portions being made deeper in tone, whilst those in the rear are subdued by a flat wash laid over them.

31. In the preparation of a drawing for tinting, the paper must be well strained and mounted before inking-in; the lines should be drawn as fine as possible, so as not to interfere with the effect of the shading (which ultimately takes the place of the lines); and before commencing to tint, the drawing should be sponged, to get rid of any deposit of ink on the lines, which would otherwise run when the colour was applied.

32. The projections of the shadows are indicated in pencil, after the drawing has been cleaned, sponged, and dried; and, being drawn with a hard pencil, are no longer visible when the tint is passed over them.

33. Before commencing to tint, the greatest care must be taken in the preparation of the ink; *the liquid ink now used on office drawings cannot be depended on;* the Indian ink (really exported from China) should be of the best quality; it must be rubbed up fresh each time when required, and covered over to protect it from dust; after two or three hours it has a tendency to deposit, and should not, therefore, be used; the addition of water and mixing also cause some deposit.

34. The same care is necessary (but in a less degree) in preparing colours, especially those which deposit, such as light red, cobalt, or yellow ochre.

35. In laying on flat tints, whether in Indian ink or colour, the board should be sloped at a gentle angle towards the operator, the brush kept full, and held in as vertical a position as possible. The application of the tint should be in short vertical strokes, commencing from the left, and when once started should be worked in horizontal layers. The carrying of the brush horizontally across from right to left is apt, when using Indian ink, to leave horizontal lines or streaks; the brush should always be kept fairly full of colour, diminishing the quantity only when the lower edge of the tint is being reached.

* Plates 4, 5, and 6 are given as illustrations of the execution of shaded drawings. In Plate 4 (from a chimney-piece, designed and drawn by the late Mr. F. P. Cockerell) Indian ink only has been used in tinting the marble chimneypiece. In Plate 5, the drawing of a fountain (by the same artist) has been tinted in Indian ink and three colours. Plate 6 is a reproduction of a drawing by the author, in which the principles described in paragraphs 29 and 30, both as regards gradation of washes and distance tints, have been observed.

36. Tinting in Indian ink, whether in flat or gradated tones, requires some experience; any deposit will be at once shown by streaks, though these can be modified or got rid of sometimes by subsequent sponging.

37. In laying on the tint great care must be taken to keep the brush equally full, and never under any circumstances to disturb the tint by an attempt at repair until it is perfectly dry; then by washing with a brush and using blotting paper, the portions too dark can be removed; those too light can be reinforced by stippling.*

38. It should be borne in mind that any abrasion of the paper makes it almost impossible to obtain an even, flat, or gradated tint. Erasure of lines—with a knife—by wetting and rubbing out—or with any ink-eraser, must not be resorted to; and it is by sponging only that a line can be removed without much sensible disturbance of the surface.

39. As this operation when applied to a single line might sometimes be difficult without sponging out those adjoining, it is usual to cut out the space occupied by the line in a piece of tracing paper, which, when applied, will protect the other lines.

40. This operation can be effected in all cases when it is necessary either to remove entirely or lessen the strength of any tint, the outline of the portion required to be removed being traced and cut out of the tracing paper first.

41. It will generally be found that any flat tint is darker at the edges: this is owing to a slight deposit, which can easily be removed with a wet brush and subsequent application of blotting paper, or else by sponging. It is necessary to point out, however, that much depends on the colour which has been used; those colours which deposit wash out too easily; Indian ink and Prussian blue, on the other hand, will require much sponging to remove them. Water-colour painters use frequently a hog's-hair brush to wash-out with; this, however, tends to destroy the surface of the paper, which, though from their point of view, is sometimes an advantage, would look like a defect in architectural drawings.

42. It is better if a dark tint be required to lay it on in a succession of washes, the only objection to that being the longer time employed and the difficulty of maintaining the same accurate outline.

43. The gradation of tints is a much more difficult operation, it being necessary to add water and mix for every successive horizontal layer; when the surfaces to be gradated are small, as, for instance, a series of windows, it is better to employ two or three saucers of the tint of varying strength, and two, or even three, separate brushes.

44. To gradate surfaces, the horizontal length of which is in excess of the depth, it is customary sometimes to rule lightly in pencil a series of equi-distant horizontal lines and lay the tints on one over the other, beginning with the darkest portion, waiting till it is dry, and then covering that a second time with a second strip, and

* Stippling is a tedious operation, performed by using a brush with a small quantity of the tint in a succession of dots and lines, filling in the portions which are too light.

so on till the whole is covered; the result is more polygonal than circular in its effect, but it is easier to do, and more regular in its gradation; and the polygonal effect may sometimes be removed by washing out and stippling.

Section D.—Perspective Drawing:

its objects, advantages, and disadvantages.

45. The objects to be attained in preparing a perspective of a building are—1stly, to assure the designer of the correctness of his intention with reference to his design; and, 2ndly, to convey to a committee or the public some idea of the ultimate effect of the building when executed. It necessarily falls short of this, because it demands one fixed point of view, and any one looking at a building is not content with that, but carries his eye from one end to the other, and looks at it from many points of view. The public, as a rule, also fail to estimate correctly from a drawing of any description the proportion, mass, or scale of a building; and, unless the drawing be actually looked at from the selected station-point, the portions at the extremities of the picture are apt to appear distorted. This should be considered carefully when determining the distance and point of view from which it is desired and expected that the drawing will be seen.

46. The execution of architectural perspective from a *plan* is a much easier and more summary process than that which has to be gone through if the drawing be made by *measuring-points* (as by a painter who has to put together his plan in his picture). The architectural student ought, however, to be well acquainted with the general rules of perspective, as occasionally greater accuracy can be obtained by using the measuring-points than by trusting to the intersection of the lines drawn on plan through the plane-of-the-picture to the station-point.

47. This is especially the case in interior perspectives when distortions on the right or left occur owing to the oblique angle at which the lines cut the picture plane. In what is known as Parallel Perspective, for instance, where the main planes of the building are either parallel or at right angles to the plane of the picture, columns or piers on the right or left will no longer preserve their relative proportions owing to the oblique angle at which the lines drawn from them to the station-point cut the picture plane. In these cases it is better to draw the central axes and determine the width by the proportion of diameter to height.

48. Some difficulty is occasionally experienced in determining the station-point which should be selected, in order to give the apparent effect of size of the building represented; if it be placed within a room, for instance, and a drawing made from it, the room will either look smaller than it really is, or there will be distortion. In looking at the interior of a room or hall from one corner or the centre of one side, the eye really covers, by the rapidity of its movement, an angle varying from 100° to 130°:

projected, however, on a plane surface from a fixed point, if more than an angle of 50° to 60° is included, the drawing would become distorted; it is advisable, therefore, to place the station-point on the plan outside the room about half its width, and this will give a satisfactory result, provided the angle included is not extended beyond 60°.

49. For exterior perspectives less than 50° is advisable, the nearest portions of buildings showing distortion otherwise, and an exaggerated distance being given to those furthest off. A good deal depends, however, on the extent of the subject; a single block of buildings, or a house in a street, will require a smaller angle than a series of blocks, as in a hospital; the height of the nearest block has also to be taken into account; a lofty tower will be distorted if it happens to come in the foreground, though it would appear right if in the distance.

50. The assumption in the mind of the artist in making a drawing is that it will be looked at from the same point of view as the station-point; as a rule, it is looked at much further off (except by a shortsighted person, or if the drawing be of large dimensions); on the other hand, if the point of sight be taken back to include an angle of 30° only, the building looks poor and weak in its sky line, and there is considerable difficulty in getting the vanishing points within convenient distances.

51. In some instances when, owing to the proximity of capitals and bases to the horizontal line, it is difficult to obtain the intersections which determine their projections, what in perspective is called an auxiliary plan should be made use of. The auxiliary plan is an imaginary plan which for bases may be assumed to be several feet lower than the actual level of the base, and can be drawn at the bottom of the paper; or for capitals above their level and drawn at the top of the paper; or, adopting another method, the horizontal line may be raised to enable the student to see the bases more distinctly when looking down on them, or the level of the horizontal line lowered to see the capital when looking up. The same process in determining the intersections is gone through as on the ground plan, but these intersections are determined much more accurately than with the acute angles there made. The points of intersection obtained are subsequently ruled up and down to the caps and base.

52. The distortion to which we have referred in paragraph 49 is the most apparent in spherical and cylindrical objects, such as domes, cornices of circular towers, columns, etc. A round ball, for instance, can only be rightly represented when its centre lies actually on the point of sight: at any other point in the drawing it becomes elliptical. This can be easily proved by supposing the ball to be enclosed in a cone, the apex of which is on the point of sight. The intersection of this cone by the plane of the picture *will only be a circle when the axis of the cone is at right angles to the plane*, and the only point where this occurs is on the horizontal line through the point of sight; in any other position the section is an ellipse.

53. The projection of a circle also on a horizontal plane will only have its major and minor axes parallel or at right angles to the horizontal line when the centre of the circle lies in a vertical plane which is at right angles to the plane of the picture

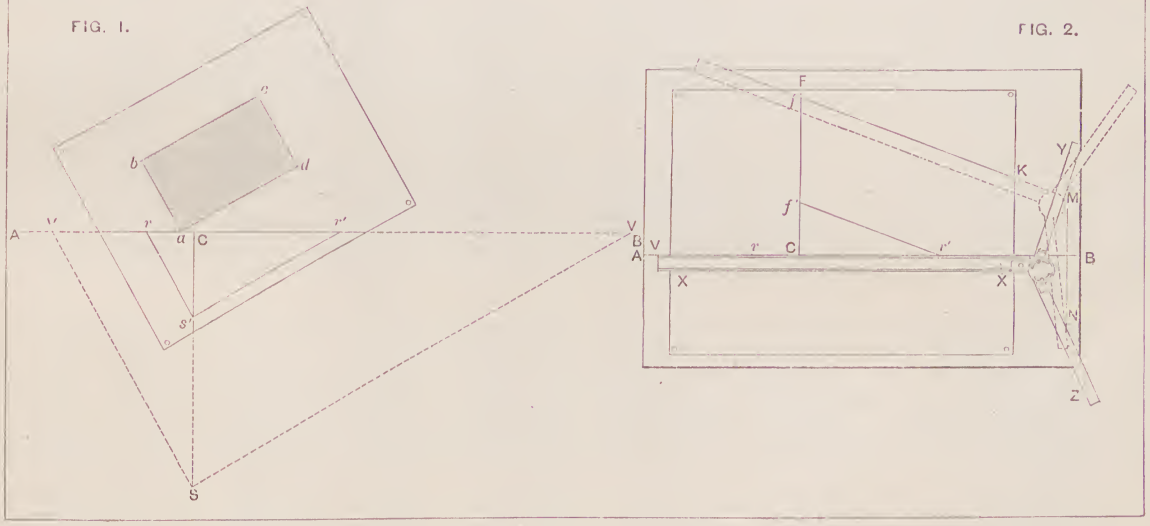
and passes through the point of sight; in all other positions the two axes will neither be horizontal nor vertical, and the curves will look wrong if the eye examining the drawing looks straight at it. It becomes necessary, therefore, to alter the curve slightly (to "cook" it, in ordinary phraseology), so that it may not appear to be absolutely incorrect in drawing.

54. An alteration of this nature is perfectly legitimate when it is confined to corrections of faults due to projection on a plane surface; it occasionally happens, however, that features do not come where they are wanted, or are not sufficiently visible, and they are therefore raised, lowered, or shifted to meet the views of the artist. So long as they are not placed in impossible positions, and the corrections are made in the geometrical drawings also, the design will gain. Unfortunately, the geometrical drawings being frequently previously inked-in, no alteration is made on them, and the architect deceives not only the public, but himself, as to the ultimate effect of his design.

55. It is generally possible to arrange that one vanishing-point at least should be included on the board or close to it in every instance; but sometimes the other must be sought for at too great a distance, and in this case it is usual to employ an instrument

I.

DIAGRAM SHOWING METHOD OF SETTING THE CENTROLINEAD.



called a Centrolinead. The Centrolinead is an instrument consisting of one long arm, x x (woodcut No. I.), which serves as the straight-edge, and two others, y, z, which are attached to the long arm by screws working in slots; these slots allow the short arms to be fixed at any angle to one another. To explain its use, let *a*, *b*, *c*, *d* (Fig. 1) be the plan of the building to be put in perspective. Determine the station-point, s, and the

plane of the picture, A B; from S draw S C, at right angles to A B. Take s' C a part of S C (say $\frac{1}{3}$rd), so that s' may be within the paper; draw $s\,v$, $s\,v'$ parallel to sides of building. Then C v will be $\frac{1}{3}$ C v'. In Fig. 2 determine A B the horizontal line, and C the point of sight; set off C v' on horizontal line equal to C v' (Fig. 1). Set up C F at right angles to A B, determine any point f as near the top of paper as possible, and take f' $\frac{1}{3}$rd of C f. Join f' v', and through f draw f K parallel to f' v', then f K will vanish in the actual vanishing-point on A B prolonged, whose distance from C = 3 C v'.

To set the Centrolinead: at a convenient distance near edge of board draw perpendicular, and on this line, equidistant from the horizontal line, A B, fix pivot studs, M N. By relaxing the screws and narrowing or widening the angle of the two smaller arms, Y Z, so adjust the instrument that the upper edge, X X, shall coincide both with the horizontal line, A B, and with the vanishing line, f K; the shorter arms, Y Z, working on the pivots, M N; then tighten the screws.

56. An ingenious instrument called the Perspectograph has been invented by Mr. Ritter, Architect, of Frankfort-on-Main, for the mechanical drawing of perspectives from plan and elevation. The instrument is of a complicated nature, and we give (by permission of Mr. English, the agent in London) the directions for its use,* as also

* A drawing table of 5 ft. length by 4 ft. breadth, which should stand free in the room, so as to be able to walk round it, will be found sufficient for all purposes.

A ground plan of the building should be prepared on tracing paper or linen, on which the different floors are traced in different colours, so as to keep the ground plan as clear as possible. This and three slips of paper, containing the most important heights of the elevation (see small sketch), are required to make the perspective.

Standing at the head of the table, facing the light, begin by fixing the ground plan in the right hand corner of the table, giving it the angle at which it is to be viewed. Then place Part A of the apparatus about two inches higher up than the highest line on the ground plan, and fix it with a cramp on either side, parallel to near side of the table. Fasten Part B in a similar way parallel to Part A, at a reasonable distance, on which fix point e (representing the position of the eye) nearly opposite to the ground plan by means of the screw. One of the paper slips is then cut at the horizontal line, and the part showing the heights under the horizon fastened to the left of e, as shown in the illustration, and the other part to the right. Then Part C, the two grooved straight-edges, are inserted into their slides. The slide f, which is fixed underneath a wooden bar, is fastened to the left block by means of screw n, and the small hand on the block is placed over the lowest line of the paper slip, and is kept in this position by tightening screw r.

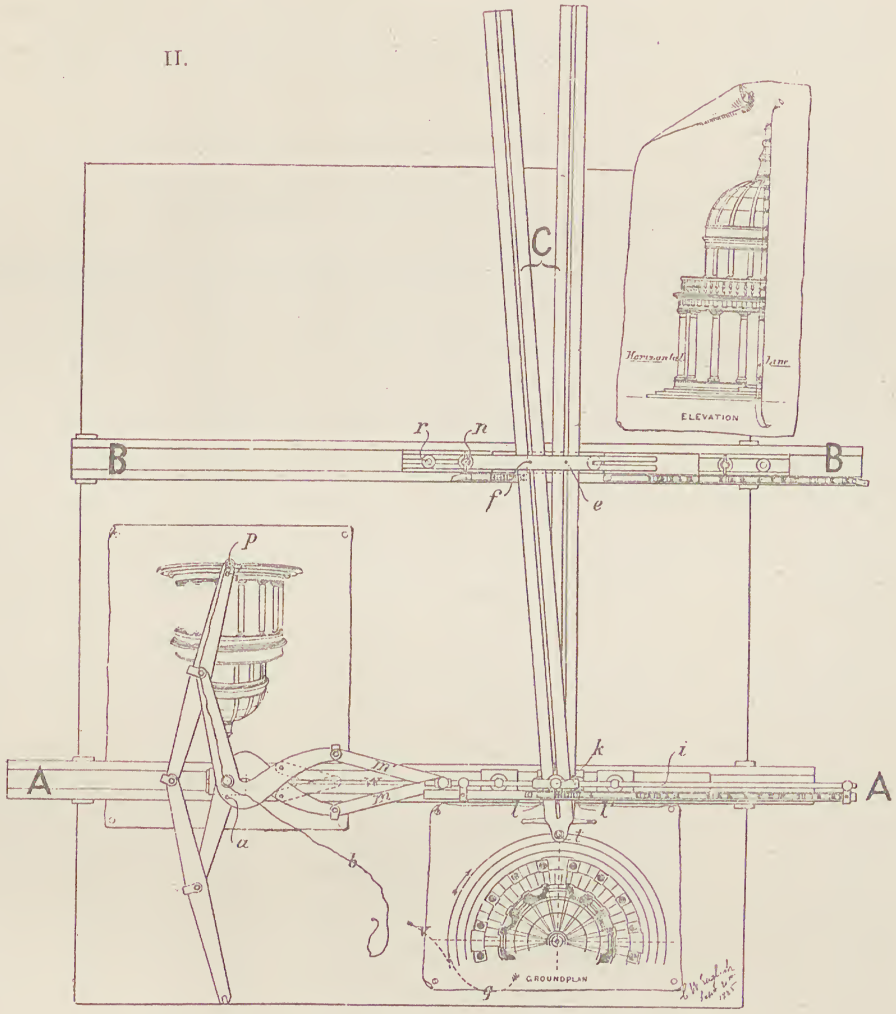
The paper on which the perspective is to be drawn should be fixed on the left hand side, between the bars A and B. If it is too large to lie between there, let a part of it go underneath the bar A; this will happen in most cases. The long wooden slide w, which is inside bar A, is then shifted, so that pencil-point p of the link motion is very nearly in the centre of the paper. In doing this, keep screw k and the screws l and l' loose. Then with the left hand hold the long wooden slide so that it cannot move, whilst with the right the tracing-point t is moved into the centre of the ground plan. Tighten the lower screws l and l'; let go the hold with the left hand, and move the tracing-point t to the uppermost line of the ground plan. (In moving the tracing-point it should never be lifted, but should always rest firmly on the ground plan.) Take hold of the iron rod i, and by slowly pulling it to the right move the pencil-point p, so that it has about the position shown in the illustration. Tighten screw k, and now fasten the second slip of paper on the strip of wood provided for it, so that the lowest line (generally the ground line of the building) is exactly under the little hand at k. Tighten securely the screws a, l, l', and e, as these will remain in the same position throughout the drawing. The instrument will now be in the position as shown in the illustration, and the drawing can commence.

It is necessary to take care to trace the lines in the ground plan in the same direction (generally from the left to the right); and in starting a line, always move tracing point t in a curve, as the dotted line q shows, so as to give it the right tendency. It should not be moved, as line v shows, as this would not produce an accurate drawing.

By giving the string b a slight jerk, any important points in the drawing can be marked by a little dot; and by pulling the string harder, the pencil is lifted from the paper, similar to the arrangements on pantographs. The pencil can be lifted out of gear, which is very advisable while altering the small hands from one height to another, and

a copy of the drawing (woodcut No. II.) which illustrates them. In the drawing of complicated objects in which spherical and elliptical curves are found, this instrument

II.



would probably be of great service, from its accurate representation, and from the saving of time in its projection. It is obvious, however, that the same corrections to which we

by pulling the string it will quite by itself go into gear again. The pencil-point should be kept sharp with a file, and should always be a true cone. A small weight over the pencil serves to give the line the necessary firmness.

The whole perspective is drawn in horizontal layers, and the vertical lines, which are indicated by dots, are drawn in afterwards with the set square. It is begun by fixing the small hands over the paper slips to the lowest line thereon, and then tracing the ground line in the ground plan, always marking any points of importance by giving a little jerk to the string while passing over such points; those corners, recesses, etc., only of the building being marked which really are seen. In altering the little hands from one height to another, the following proceeding is recommended:—Loosen screw *k*, then loosen screw *r*, and move the block until the hand stands over the new height. Then tighten screw *r* again. Then get hold of the iron rod *i*, and move it till the little hand stands over the same height on this scale; then tighten screw *k*. Now trace the lines in the ground plan belonging to this height. Thus the hands are altered from height to height, and the corresponding lines in the ground plan traced. It is advisable

have already alluded in the drawing of domes and octagons (when not in the centre of vision) would have to be applied here. We are also of opinion that artistic effect is of as much importance in a perspective drawing as mechanical correctness, and we should be content with less mathematical accuracy if the draughtsman succeeded in giving us a more artistic conception of the building he was delineating. It is evident that even with this instrument an artist would be required to complete the drawing.

SECOND DIVISION.—DESIGN.

Section A.—COPYING OF THE ORDERS, AND THEIR APPLICATION.

57. We have already referred (paragraph 3) to the custom which obtains in English offices of setting a pupil to copy the Classic orders,* in order to train his hand to the use of drawing instruments. There are, however, other objects of perhaps even more importance than this, viz., the training of the eye to a recognition of proportion and scale, and the cultivation of the reasoning powers and of the memory, such as may be attained by some more intelligent system of application than by simply copying.

58. There are two methods by which this may be put into practice: 1stly, by the drawing of the order to a scale different from that of the copy, and the calculation of the principal parts and their mouldings in relative proportion to the diameter of the column; and 2ndly, by the application of an order to some design of a simple character.

59. As regards the first method: in former times, previous to the Gothic revival, when little but Classic architecture was studied (and when to deviate from the exact proportions laid down by Vitruvius was accounted a sin!), the half diameter or module was defined as the unit; and the proportions of the column, its entablature and mouldings, were calculated at so many modules or subdivisions of a module. It is too much to expect at the present day that the student should commit to heart these minute subdivisions; but the main relative proportions of diameter of column to its height

only to draw the most necessary lines of the perspective. (The third slip of paper is kept on the side of the elevation, and therefrom the number of the height to which the hands are to be placed can be seen.)

On coming to the horizontal line, the left hand block carrying slide *f* must stand right against slide *e*. Then slide *f* must be transferred to the right hand block, which is done by moving the right hand block up against slide *e*, then loosening screw *n* on the left hand block and tightening the corresponding screw on the right hand block; proceed as before. In some cases pencil-point *p* may come rather close upon bar A; if so, the paper must be moved a certain distance (say six inches) higher up. The paper slip on bar A is now taken off and moved the same distance (six inches) to the left and pinned on there again. The paper slip on bar B remains exactly as it was before; proceed as before.

For larger bird's-eye views it will generally be found necessary to take away the two links *m* and *m'*, and to insert in their stead the two links of half their length, as shown by the dotted line; but then both the paper slips (on A and B) must be reduced to half the scale of the ground plan.

* Of the five Roman orders, the Tuscan is only a simpler form of Doric, and the Composite a combination of the Ionic with the Corinthian; these may therefore be omitted, and in their place the Greek Doric and Ionic orders studied and compared with the Roman examples.

and to the depth of architrave, frieze, and cornice, are not difficult to learn; and by subsequently drawing out the mouldings to a larger scale, their subordination to the main divisions of entablature and column may be gradually acquired by the system here suggested.

60. The application of the orders to a design extends the field of study, and a number of problems occur which are never thought of, when a single column is being drawn, the solution of which is absolutely necessary, if the student desires to understand thoroughly the meaning of many of the features he has already copied. The intercolumniation or distance of one column from another (always taken from centre to centre), the slope of the pediment, the way in which Greek temples were roofed, the uses of pilasters and antæ, the arrangements of stone beams and flat stones with coffers cut in them which form the ceiling of the peristyle or portico; all of these are useful problems to be studied. The small edition of Stuart and Revett's "Athens," and Wilkins' "Prolusiones Architectonicæ,"* will assist the student in these researches. The subject for these designs (made for the purposes of study *only*, and not necessarily for execution) might take the form of an entrance to a Public Park, or a Portico to some Museum, with the Roman or Greek Doric order; a stone Screen (similar to the example at Hyde Park Corner or in front of Grosvenor House) with the Ionic order; a semicircular Porch (as at St. Paul's Cathedral), or a Mausoleum with the Corinthian order.

61. A somewhat similar system of training was adopted in the Elementary Class of Design of the Architectural Association, where, in fact, the principle was carried further.† A feature being decided on, such as a portion of a cloister or an entrance, portico or porch, to an important building, the student was expected in each month to produce a design based on one of the recognised ancient styles of architecture, taken up one after the other in their chronological order; references being given to the best illustrated works in each subject. The rapid change from one style to another tended, however, to the confusion of the student's mind, and so many of the competitors seemed to be unable to grasp sufficiently the proportions and details of the several styles, that it was found necessary to change the system and deal only with two styles, insisting first on a simple copy of some feature, one month; to be followed in the next month by a design or original treatment of the same.

62. The subsequent training of the pupil depends a good deal on the work of the office in which he may be articled. If the preparation of designs in one of the

* "The Antiquities of Athens," by James Stuart and Nicholas Revett. 3rd Edition, 1885. "Prolusiones Architectonicæ," by W. Wilkins, R.A. London. 4to. 1837.

† Extract from Syllabus of Elementary Class of Design, Architectural Association, 1883-84. Subject: Principal Entrance, Portico or Porch, to an important Building. Nov. 30: Greek; A Tetrastyle Portico to a Temple. Dec. 28: Roman; A Tetrastyle Portico to a Temple. Jan. 25: Romanesque; Narthex to an Early Christian Church or Basilica. Feb. 22: Lombardic; A Projecting Porch to a Cathedral Church. March 21: French, 13th Century; A Tripal Portal between the Towers of a Cathedral Church. April 25: English, 15th Century; A Projecting Porch to a Cathedral Church. May 23: Italian Cinque-Cento; A Projecting Porch to a Public Civil Building. June 13: English Renaissance; A Projecting Porch to a Baronial Hall.

mediæval styles forms an essential element, it is necessary that he should acquire some knowledge of the features, details, and mouldings of Gothic work. For this purpose, Sharpe's "Parallels," and Brandon's "Analysis of Gothic Architecture," serve as useful text-books, whilst Pugin's "Examples and Specimens of Gothic Architecture," and his work on "Normandy," give almost every variety of the periods of Gothic art. We do not consider that in his early education (except as a means of training the hand) the student should attempt to copy the late examples of the perpendicular and flamboyant styles, still less the debased examples of the later Renaissance, however picturesque they may be. Amongst other works, the late Mr. William Burges's book on "Architectural Drawing," in its dissection and analysis of Gothic buildings, and more particularly of the choir of Beauvais Cathedral, will be found to be invaluable to the student.*

63. In foreign academies where the long tradition of teaching in the schools has resulted in more or less uniformity of style in design, the elementary studies rarely go beyond the employment of Classic form and detail; and, apparently, the French and German client is content with the style of the period, and does not express a preference for any bygone style.

64. In England the contrary is the case, and according to the taste or predilection of the client (who may choose Italian for his office, Gothic for his church, Jacobean for his town house, and Tudor for his villa), so the student must prepare himself for emergencies by a more extended acquaintance with bygone styles and periods.†

65. Towards the end of his second year in the office, it is very important that the pupil should have some opportunity of testing his knowledge by attempting to work out some simple practical design, of a similar character to those on which he has been working in the office, so as to oblige him to think for himself, and to search among the drawings of the office for solutions of those problems in construction and design *which he may have traced or copied a dozen times without recognition of their value.* If, at first, there be a tendency to copy his Principal's work too closely, no great harm will be done, and subsequently the frequent criticism on the design (such as is given in the Schools of the Royal Academy, in the Architectural Association, and by the Principals themselves), and the alterations consequent thereon, will gradually evolve some variations in his design, so that, in course of time, a certain novelty of treatment will develop itself, which will give individuality to his work. The constant study of illustrations of old work, and notes on its application to modern buildings, will greatly assist in this development of individuality.

* "Architectural Parallels," by Edmund Sharpe. Fol. London, 1848. "Analysis of Gothic Architecture," by Raphael and J. A. Brandon. 4to. London, 1847. Pugin (A.), "Specimens of Gothic Architecture." 4to. London, 1821. Pugin (A.), "Examples of Gothic Architecture." 4to. London, 1838. Pugin (A.) and Le Keux (T.), "Normandy." 4to. London, 1828. Burges (W.), "Architectural Drawings." Fol. London, 1870.

† Some architects have the courage of their own opinion, and concentrate themselves on one style alone. Fortunately for modern architecture this is not altogether unappreciated, and to mention only those who have gone, Professor Cockerell in Classic work, and George Edmund Street and William Burges in Gothic work, always remained faithful to the style of their convictions.

Section B.—THE STUDY OF DESIGN.

66. One of the definitions given in dictionaries of the verb "to study" is "to form and arrange by thought." The thoughtful architect carries the meaning of the word further, as including not only thought, but action. The painter uses the word "a study" to signify a drawing made for the purpose of acquiring knowledge as a means to an end, but not necessarily the end or final aim of his work. By "the study of design" we would therefore mean those tentative experiments which will eventually terminate in some finished work, such as a set of designs.

67. The number of Studies which will have to be made depends, 1stly, on the amount of experience and ability of the student; 2ndly, on his power of grasping the studies in his mind without necessarily transferring them to paper; and, 3rdly, on the value which he himself sets on the production of a carefully considered design which shall be full of originality and thought.

68. The greater number of executed works are probably not studied at all in the sense in which we employ the word. There must be some arrangement in the plan arising out of its constructive necessities—walls in the upper stories should be over walls in the lower; piers over piers, etc.—the details also of a window or door may be a copy or a remembrance of some ancient or modern example, and the gable from another—without any attempt to make them harmonise with each other. Features also are often introduced as features, and not because they are necessitated by the character or special requirements of the building (a bow window, for instance, is a charming feature in a house, but it is out of place in a church or a museum; a traceried window is a beautiful feature in a church, but out of place in a picture gallery).

69. It is the province of the architect to give an æsthetic quality to the arrangements of his building, beyond the mere utilitarian requirements or construction, and to bring the various features introduced into harmony with the materials employed in his design and with the destination of the building. Frequently what he may consider to be an unthought-of form may really be only a remembrance of something he has seen elsewhere; but yet it may have become so altered and modified in proportion and detail as to constitute an original treatment.

70. In bygone times, when the paper and instruments at the architect's disposal were scanty and defective, his study of the design took place on the work itself; and it rather consisted in copying some previous building with avoidance of its failures; alteration of its plan when necessary, to meet any different demands or to suit the site; and the addition of any new charm of detail which he, the designer, could think of.

71. This method is no longer possible; the requirements of the present day necessitate the production of drawings which must be skilful and attractive—if for a Competition, accurate and clear—when for a Contract.

72. The custom observed in the working-out of a design varies so much according to the special idiosyncrasy of the student that it would be difficult to lay down any series of rules to which exceptions might not be taken. Some men have the special faculty of forming in their mind (even from an early period in their studies) a distinct conception of what they want, and are able to draw it out without any serious deviation from their first idea; the study of design with them has, in other words, been going on in the brain before they put it down on paper. Others can only develop their ideas gradually as they cover the site set out with a network of lines which suggest the relative position of the various rooms required. Others, again, commence by setting out to scale all the important rooms; trusting to "future inspiration" for the convenient arrangement of the rooms in relation to each other, and for picturesque or monumental character. All we can hope to accomplish here is to suggest the principles which should guide the average student in the setting out of his design.

73. It is better, in commencing, to sketch first to a small scale [say $\frac{1}{16}$", or $\frac{1}{32}$" in the case of a large building], as it is much easier to grasp the relative proportions in a plan of small dimensions; and it also takes less time to alter, if the first idea be not satisfactory. It is not necessary, when beginning, to trouble about the exact dimensions of every room, provided the chief ones are approximately of the required area; thus, in a House, the *entrances*, *hall*, *staircase*, and the *approach* to the principal reception rooms should be paramount in the student's mind rather than any of the eventual picturesque features, such as recesses or bow windows. In a Public Building the *entrance-hall*, *staircase*, *corridors*, *and halls*, should be first considered, leaving the minor services to be grouped round them.

74. The student should not be content with one Study, but should make two or three combinations of plan.* This system enables him to grasp his subject better, and, if his first sketch proves unworkable when he comes to his elevation, he can take up a second combination.

75. When a plan seems to be sufficiently blocked-in to meet the programme, so far as the general arrangement is concerned: the positions of windows, doors, and fireplaces should be set-out and the walls hatched in pencil or blacked-in. The fenestration or spacing-out of the windows is invariably regulated in large rooms by the construction of the floor or roof; and the distance apart of the beams or girders of the former, and the trusses of the latter, should be determined, even if subsequently architectural features which require rearrangement are adopted.

76. The principal elevation and at least one skeleton section should then be

* In the design of domestic buildings what is known as "engineers' squared paper" will be found useful; this paper is ruled with lines forming squares $\frac{1}{8}$" wide. Neglecting, for the moment, the thickness of the walls and counting each square as two feet (the plans being, therefore, to $\frac{1}{16}$" scale), a variety of combinations of rooms can be quickly set out. If, when this is done, the three or four studies be tinted in colours representing the various destinations—thus, red to represent the hall and passages, blue for the sitting-rooms, and brown for the offices—it is possible to judge better of the value of the several combinations as regards economy and compactness of plan.

set-up, and if the student has been able to so concentrate his whole attention on his first scheme as to constitute a complete sketch, it is best then to tint the colour of his building materials and roof, and to show the voids of the windows, with dark grey or black, in his drawing, and then leave it as a first impression.*

77. If the plan be blacked-in, the windows, roof, and walls tinted, it is evidently difficult to make any alteration on this first sketch; and then tracing paper should be used on which to make the next studies [still to the small scale we would suggest]. The planning of the upper floor, basement, and roof should be arranged and drawn on tracing paper laid over the ground plan. The rooms of secondary importance should now be put in to scale, and the main walls drawn. Elevations and section follow in due course; and now, perhaps, it is time to think of the principal features which should constitute its architectural character.†

78. The number of studies, roughly sketched-in or carefully elaborated, which may be required in this manner depends—1stly, on the student's experience in design; 2ndly, on the time he can devote to further development; 3rdly, on the chance of his having been happily inspired in his first conception; and 4thly, on the strength of his determination to produce the very best design he is capable of.

79. The tracings constitute the second series of studies, and the time has now

* The students of the "École des Beaux Arts," Paris, are required to produce the plan, elevation, and section of the design required in a single day for the ordinary competitions. It may be left in outline only, but the doors and number of windows and the principal architectural treatment of the elevation and section have to be shown. These drawings are made in the "École" itself in compartments or recesses about 6 ft. wide, separated from one another by a screen so that the students are unable to see one another's design. A moderator remains in the room to keep order and see that the students do not communicate one with the other. The students enter at 9 a.m., and having taken a tracing of their design, leave the original with the moderator before leaving. They take their lunch with them, and have the privilege of stopping till 9 p.m. At a subsequent period they work out a study of their complete design from the tracings, black in the walls on plan, project the shadows, and tint the elevations, and these are submitted to the "Patron" or Professor of the "Atelier," who advises generally on the drawing:

1stly. If it be worth working out at all according to the sketch [which may have been an incorrect interpretation of the programme].

2ndly. How it should be worked out to improve it without being put "hors de concours" [in consequence of too great a departure from the original] by the Jury of the School.

3rdly. Whether the student should prepare another design for practice only.

The subsequent work follows much the same course as we suggest for the architectural student in England, with this difference, that the student is able to obtain the continual advice, and occasionally assistance, from the more advanced students of the "Atelier," who in their turn secure more of the "Patron's" time in his advice on their designs.

† It may seem strange, but it is nevertheless a fact, that a large proportion of students frequently commence their plans by inserting the breaks of elevation with a view to its future architectural effect; without considering whether these breaks will in any way conform to the requirements of the plan. They afterwards find it necessary to expend their ingenuity in attempting to squeeze the plan to fit them, instead of the proper method of allowing the breaks to arise out of the special arrangements of the plan. In work of a domestic character, the former system [insertion of breaks] may sometimes lead to a picturesqueness of shape of various rooms which the regular parallelogram might not have given; and if in subsequent sketches the student can make this harmonise with his programme the design may possibly gain. In monumental buildings, however, it is invariably fatal; for the very essence of the design is that it should faithfully follow the plan of the larger rooms, halls, or galleries which constitute its character; and if it be found that the principal elevation appears poor and weak from want of projecting breaks, then is the time to rearrange such portions of the plan as will meet the architectural requirements. This will not only result in a better and more practical plan, but it may suggest some original treatment which had not before occurred to the student.

arrived when the design, its plan, elevation, and section, may be set-out to the scale required in the competition. If the studies on the tracing paper are thoroughly worked-out, that is to say, if the problem has been fairly solved, the student may, in his next course, commence the drawings which will eventually be sent in; and, beginning with the plans, these should first be set-out, portions of the walls being hatched in pencil, to enable him to judge better of their arrangement.

80. When the elevation and sections are set-up it may here again be advisable to make use of tracing paper in order to study various portions of the details, and (if the scale of the drawings required be small) to set out some portions, *e.g.*, the decorative features, mouldings, and ornament, to a larger scale, so as to understand them better; and reduce them back again to the original scale when they are settled. This course is very necessary for students who have only a vague idea of what they intend to represent in the smaller scale drawings; we refer later on (paragraph 89) to the making of perspective sketches of various features, the value of which, however, depends on the student's practice in drawing from ancient buildings.

81. Architectural design being, generally speaking, an effort of memory or an attempt to adapt something which has been seen elsewhere: the result of this effort or attempt will either be a close copy if the student's memory be good, or bear little resemblance to what he really saw if the reverse. In either case it may be considerably altered, perhaps even improved, if in adapting it he has allowed its construction—the material employed—and its altered purpose to guide him in its adaptation.

82. If the student's earnest desire be—not to copy, but to carry out these principles just enumerated,—we advise him to form a collection from the first either of illustrations from the various professional papers,* or to avail himself of such facilities as exist, to trace and copy the characteristic features of the style he may have elected to design in; and in all cases to make careful studies of their ornaments and mouldings.

83. There is another advantage to be obtained by this practice: we frequently find that students adhere too closely to a few special features of their own; a favourite bow window, a porch, a gable end, or even a tower which they insist on bringing into their design, whether it is suitable to it or not. The tower is, perhaps, the greatest favourite; it is introduced on all occasions, whatever the building may be, but especially when it is of a monumental character. Churches and town-halls are the only buildings which by their requirements and long custom have a distinctive right to a tower; in a museum, public library, or picture gallery, it is evidently out of place, because it may obscure the skylights and throw reflected lights on to the pictures and objects in the gallery or museum. A tower is sometimes necessary to a country house, or to a large block of buildings, to give importance to certain portions of the design,

* The value of these English professional journals cannot be too highly estimated; in fact, we consider the very great progress which has been made in the last fifteen years in the high standard of design and draughtsmanship in this country to be due in great measure to the very complete drawings of ancient and modern work which thereby have been placed within the means of the poorest student; and we cannot be too thankful for the energy and enterprise which has led to their reproduction, and in many cases to their great excellence.

but if every architect were to insist on placing towers in his building, they would not only interfere with the lighting of the surrounding thoroughfares, if in a street, but would destroy one another in their effect.

84. Another practice, on which it is necessary to insist, because of its frequent neglect by those who design in the Classic style, is the drawing-in of the lines representing the joints of stone, brick, or other material. These constitute the most important element of truthful design; and should govern or suggest the treatment of whatever features may be introduced. The indication of the joints, both in horizontal courses and in the construction of arches of all kinds, is also invaluable for giving the scale.

85. The great progress which has been made in architectural design in the last few years in England, is due in some measure to the influence of the Gothic revival, which has led to an insistence on the application of true constructional principles to the development of architectural style. In Gothic design the joints are always shown; in fact, they form an important element in the effectiveness of a drawing of Gothic work. We have in Part I., Second Division, dwelt on the various methods of execution, whether in line or tint, which may be employed in the artistic finish to be given to drawings, so that it is not necessary again here to say any more.

86. The drawings which are prepared in the Architectural School of the Royal Academy must, under the Rules, be executed in the School itself, and in a limited time, *i.e.*, three evenings per week from 6—8 p.m.; it is not possible, therefore, to carry them so far in artistic finish as those which are made in competition for the various medals and prizes offered elsewhere—or those prepared for public competitions; the student has, therefore, to consider this, and is obliged to commence his finished drawing before his design has been adequately studied. On the other hand, he has the advantage of obtaining skilled criticism on his design, which will facilitate his work.* After all, it must be considered that these studies are only the *means* to an end, and it is much better that a design should be well studied (from an educational point of view) than that it should be sent up imperfectly thought-out (though finished), in the hopes of getting through the classes as soon as possible. The object of the instruction given in the Academy is not to increase the student's collection of drawings, but to teach principles of design.

87. In after life the student is rarely able to obtain the advice of his brother-student as in France, where one's fellow-pupils of any "atelier" can always be counted upon to advise and assist in the preparation of public competition work during the evening, a practice we should much like to see adopted here.

88. It will therefore be only in the classes of the Architectural Association that he can avail himself of that criticism which the fresh eye of a fellow-student of even inferior talent is able to give. Such criticism may result not only in a much higher

* Of course it may sometimes retard it, if in the advice given suggestions are made which carry the design further than the student himself contemplated at first.

Academy are thrown open to the architectural student if he chooses to avail himself of the privilege; but since the foundation of the Architectural School in 1870 only two or three have availed themselves of the opportunity afforded them to study in the two schools above named.*

* In the "École des Beaux Arts," at Paris, a careful drawing of an antique statue is one of the tests of power of drawing required before passing to the upper school. The late Mr. William Burges frequently insisted on the great value which could be derived from the drawing of the antique figure; and Mr. Gwilt in his "Encyclopædia" (published in 1842, and since revised by Mr. Wyatt Papworth) gives similar advice, but with the proviso that the student should learn first how to draw ornament.

Messrs John Greenwood & Sons:
New Business Premises
Ray St E.C.
Brick Backing
Block for Carver
Trimmer 9"x4"
Centre line of dial
Block for Carver 12" thick
11½" thick
R.W.P. recess stops here
Underside of Joists
Carved Band
Left in block for carver
Name of Firm and foliated enrichment.
Centre line.
Centre of Party
7'0" from centre to centre
York Template

WAREHOUSE, RAY STREET, E.C.

Rowland Plumbe, F.R.I.B.A.

Part II.

OFFICE WORK.

FIRST DIVISION.—CONTRACT AND WORKING DRAWINGS.

Section A.—CHARACTERISTICS.

94. The essential characteristics of a working drawing are—(*a*) That it should be clear and accurate. (*b*) That it should be full. (*c*) That it should be well figured and lettered. (*d*) That the colours used in its tinting should be easily distinguishable one from the other.

95. (*a*) The first requisition commends itself: if a working drawing be not clear it involves more trouble and expenditure of time in its further elucidation; if it be not accurate, it may cause mistakes in the setting-out and lead to extra cost in the work.

96. (*b*) By the word "full" we mean that each drawing* should contain, according to its scale or purpose, all that information which it might be expected to give. The drawings which we are enabled, by the kindness of Mr. Alfred Waterhouse, R.A., and Mr. Rowland Plumbe, to publish, are illustrations of what may be termed "full drawings," and show more fully what we mean.

97. The illustration of a warehouse by Mr. Rowland Plumbe [Plate 7] is reduced from a half-inch scale detail, and is an excellent example. It deals only with the main front; and it shows an elevation of half the exterior and half the interior; a section of the front wall with variations through one portion not sufficiently represented in the other; indications of the plan of floor-timbers at each level, where they bear upon the main front; and it contains figuring, lettering, and all other requisite instructions.

* There is a tendency sometimes, in drawings which are prepared in haste, to evade the settlement of difficult points, in the hope that in course of execution something will turn up to solve the difficulty. In works not executed by contract, and for which the client is willing to pay by a "schedule of prices," there is sometimes an advantage in this method of leaving details to be settled during the building; and in some hands the work invariably gains; a more original, a simpler and a more artistic treatment sometimes revealing itself to the architect in the presence of his work during its execution than when on the drawing-board in his office. It is in this respect that the architects and master-masons of old had a distinct advantage over the architects of the present day; a glance at the drawings of John Thorpe, Inigo Jones, or Wren, reveals at once to how much greater extent were the directions then given on the works. These drawings [which sometimes are mere sketches, with part of the elevations drawn in perspective] would be worse than useless were we to attempt now to work from them, and they show that in the setting-out of the plan, material modifications were made from the drawings sent to the workmen; whilst the design of the elevation and sections grew from day to day during the actual execution of the building.

98. A second illustration of Mr. Plumbe's work [Plate 8] represents one of his half-inch scale drawings of a bay of a church, showing every detail which would be required for its execution.

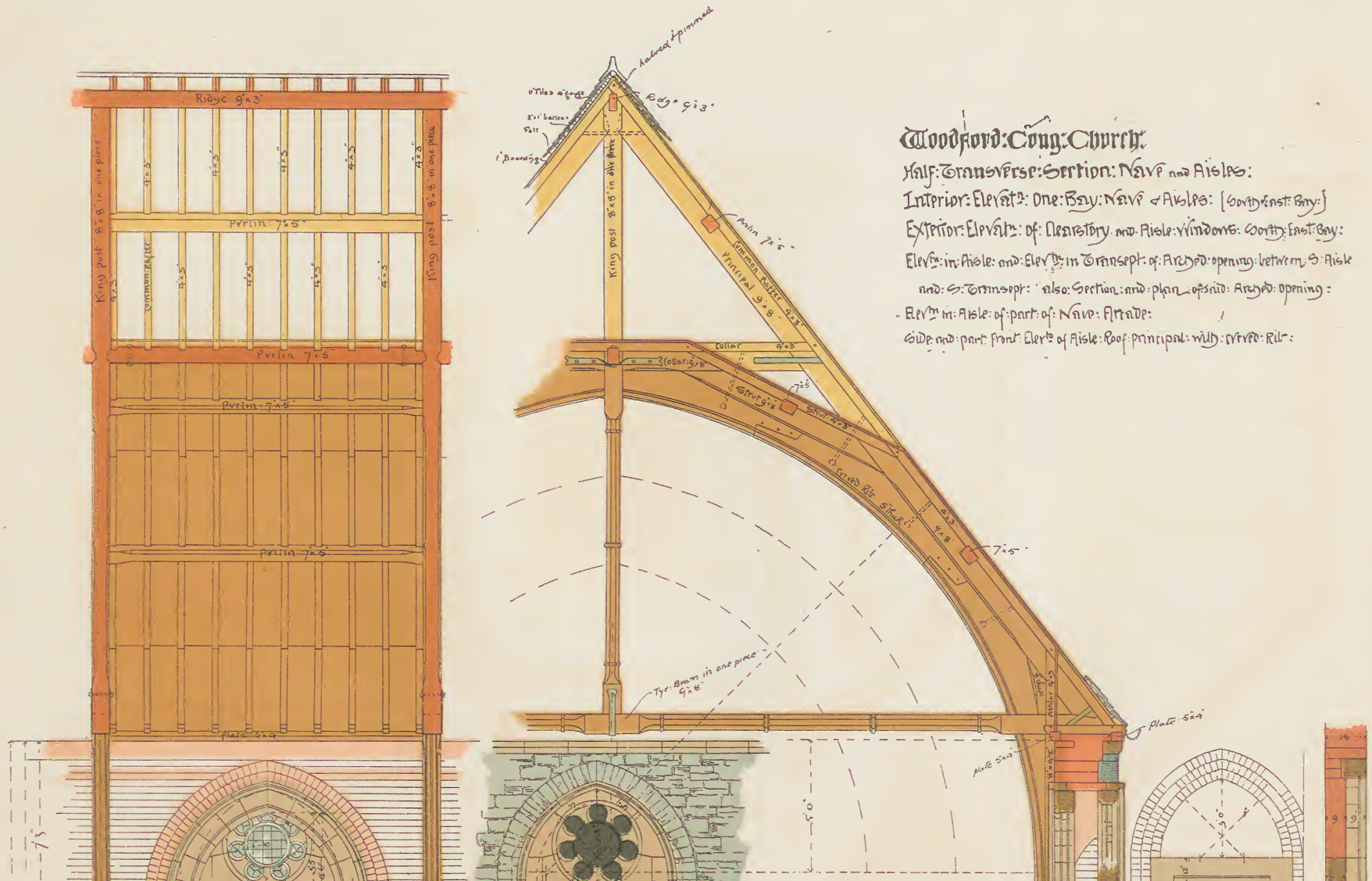
99. Drawings of this type have this great advantage: that the workman finds all he wants to know on one drawing, instead of having to search through several. The Workman is rarely able to grasp the relative bearing of the various features in a design in the same way as the Architect who has drawn them, or the Quantity-surveyor who has analysed and dissected them; he sees nothing more than there is on the one drawing, and if he has to search through a dozen to find the variations which may occur in the immediate portion he is engaged upon, he is just as likely as not to make a mistake in his selection. In France, where there is a separate contractor for each trade, it is possible for each of them to make himself thoroughly acquainted with every portion of the construction with which he has to do; and even, if consulted, to point out to the architect where some portions of the work may be economised, and others may require increased outlay. Here in England the contractor, trusting to the quantities alone, rarely takes the trouble to look at the drawings, and the foreman (occupying a subordinate position, and being probably only some intelligent workman who has risen from the bench) has not had that training and thorough acquaintance with drawings which will enable him to understand clearly the architect's intention throughout the work. No pains, therefore, should be spared to make every drawing which is sent to the work as clear, accurate, and full as possible.

100. In the plate of Mr. Waterhouse's own residence, Yattendon Court [Plate 9], we have not deemed it necessary to reproduce more than would show how a ground and roof plan should be drawn, written upon, figured, and coloured; and similarly with an elevation and section. We have included a detail of an oriel window to show the special precautions which have sometimes to be taken in the corbelling-out to ensure sound construction and "breaking of joints" in the stonework, and for this purpose have tinted the courses of stone on plan and in elevation in different colours.

101. (*c*) As the exact setting-out of the work depends upon the dimensions of the several parts, and as æsthetic considerations do not weigh with the workman, it is of the greatest importance that all the calculated dimensions—the thickness and relative height of walls—should be indicated in plain and clear figures easily to be understood by him. These figures, as also all the description and writing on the drawings, should be in legible characters, in which clearness is of more importance than style of letter or figures.

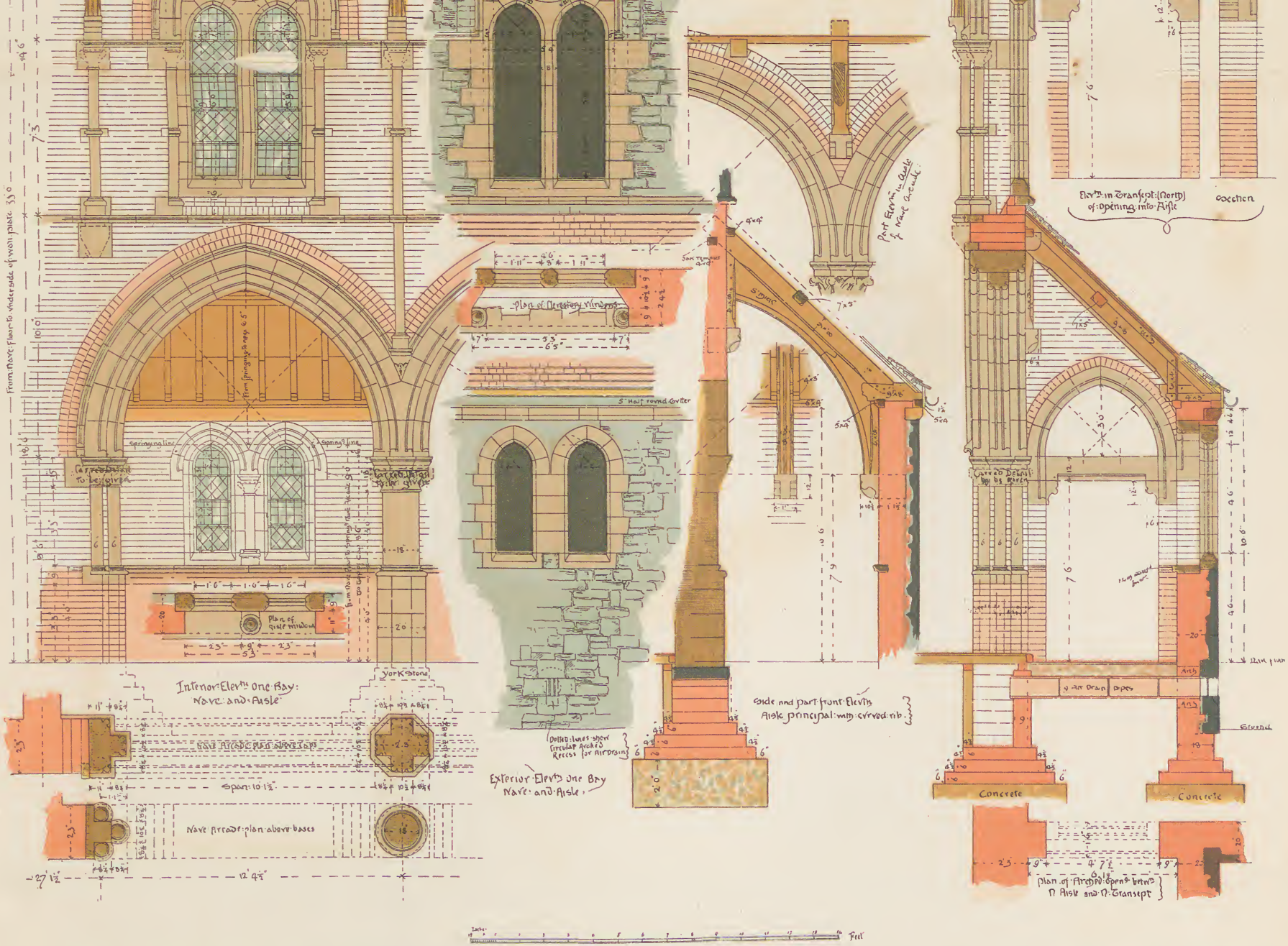
102. (*d*) The completion of the drawings will depend in a great measure on the colours which have been employed to distinguish the materials one from the other; as, however, we refer to this subject later on (Par. 117, *et seq.*), it is not necessary here to enter into it further.

103. Working drawings may be divided into three classes:—Firstly, those which form part of the contract; and are signed, as such. Secondly, those which are prepared



Woodford: Coug: Church.

Half: Transverse: Section: Nave and Aisles:
Interior: Elevat.: One: Bay: Nave & Aisles: [South-east: Bay:]
Exterior: Elevat.: of: Clerestory and Aisle: Windows: South: East: Bay:
Elevs.: in: Aisle: and: Elev.: in Transept: of: Arched: opening: between S: Aisle
and: S: Transept: also: Section: and: plan: opposite: Arched: opening:
Elev.: in: Aisle: of: part: of: Nave: Arcade:
Side: and: part: front: Elev.: of Aisle: Roof: principal: with: curved: Rib:

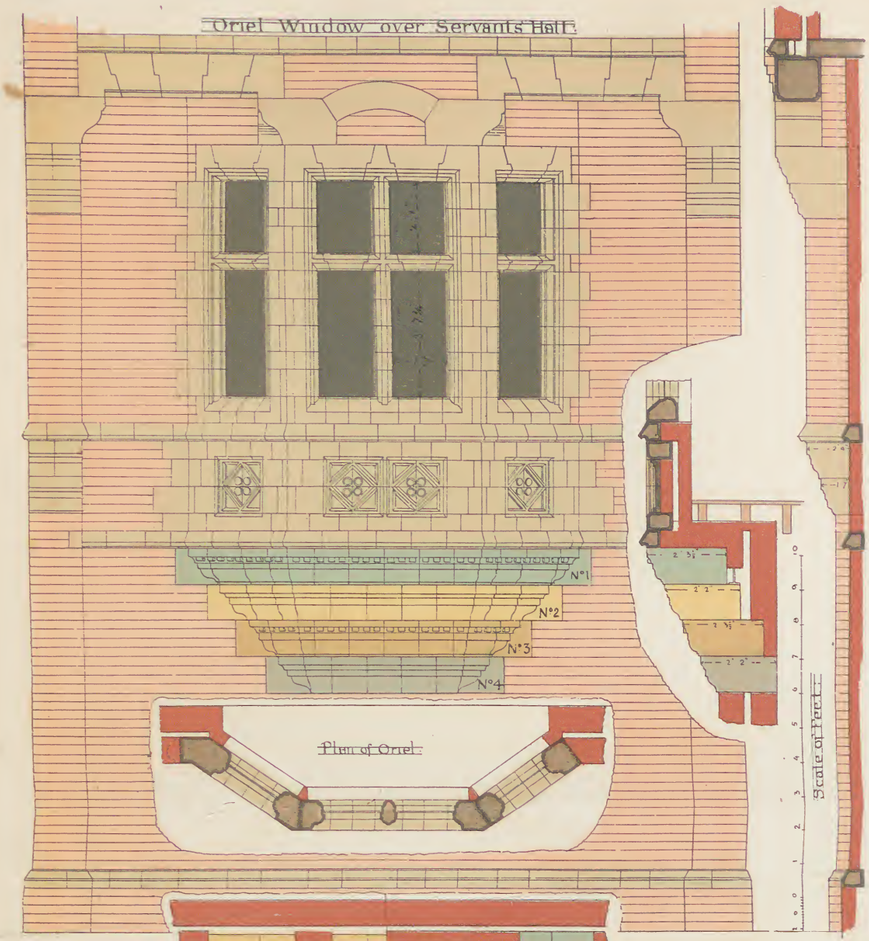


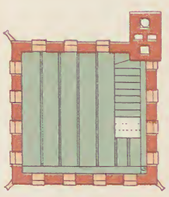
BAY OF WOODFORD CONGREGATIONAL CHURCH.

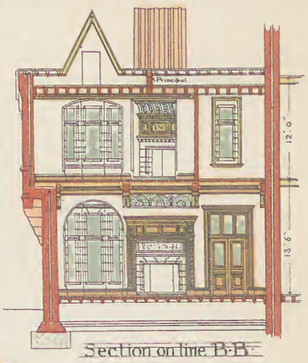
Rowland Plumbe, F.R.I.B.A.

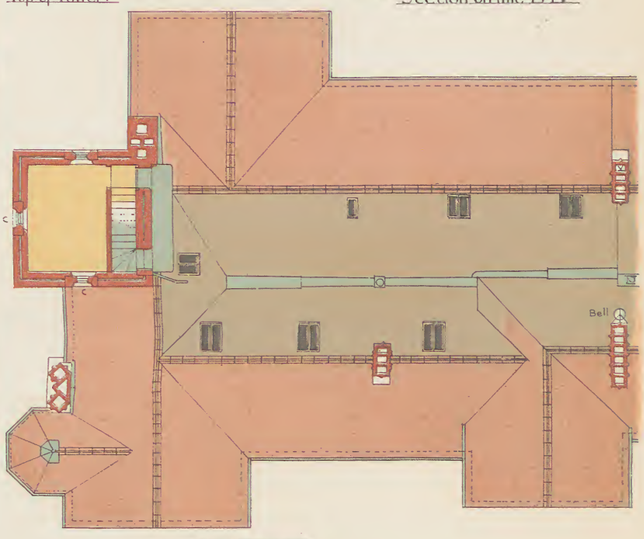
Yattendon Court :

Alfred Waterhouse R.A. Architect :

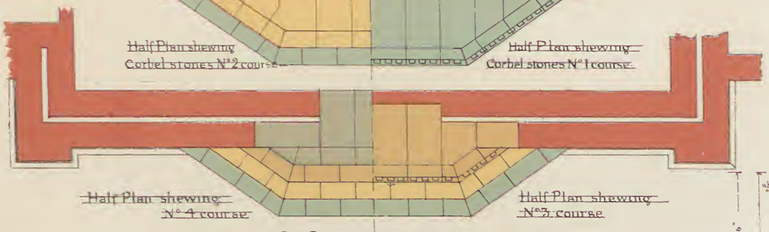


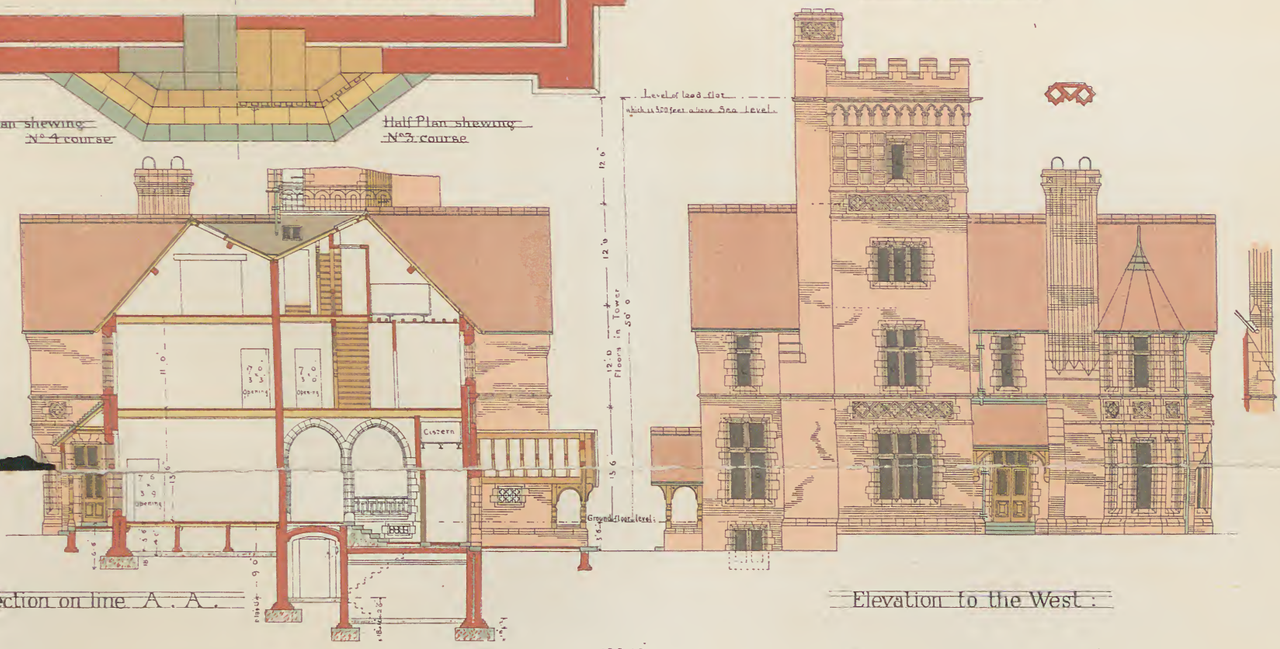

Top of Tower.


Section on line B.B.



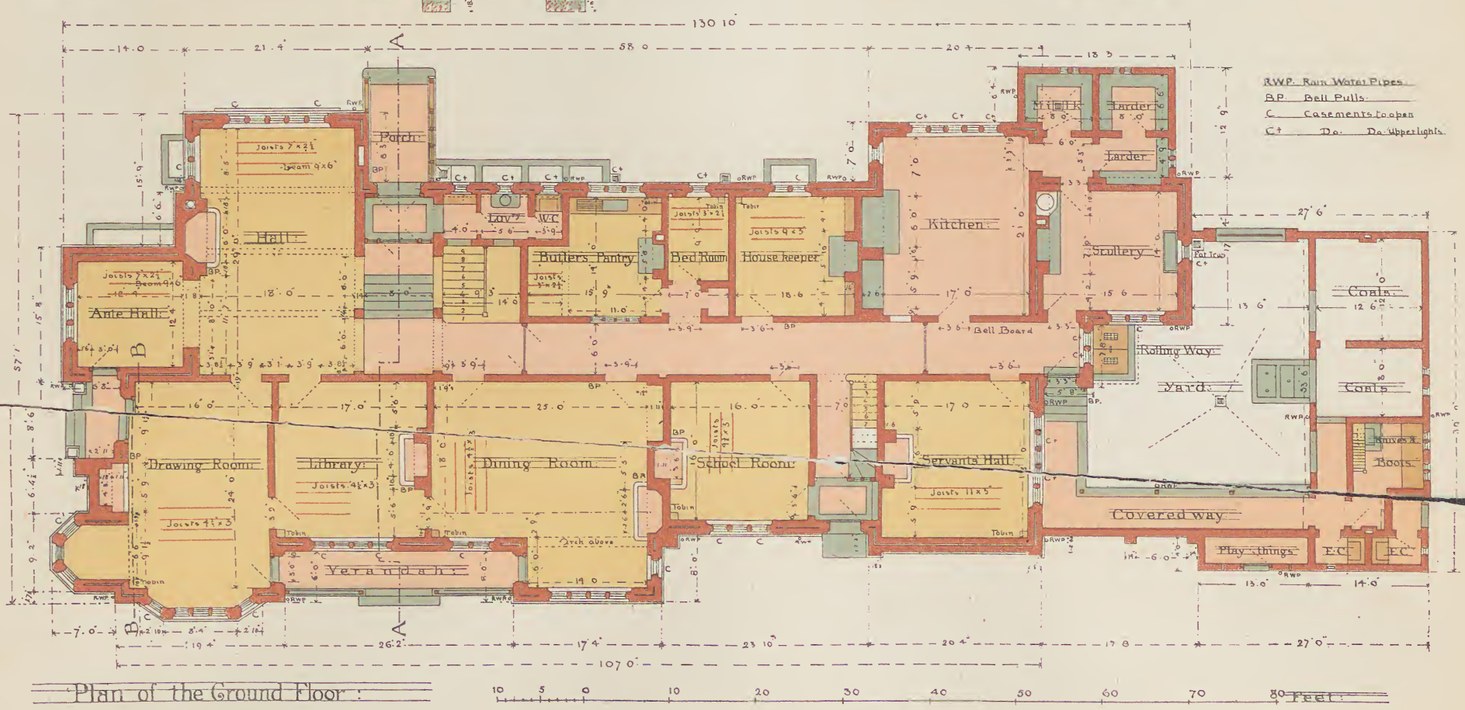
Part Plan of Roof :





Section on line A. A.

Elevation to the West :



Plan of the Ground Floor :

10 5 0 10 20 30 40 50 60 70 80 Feet

YATTENDON, HANTS.

Alfred Waterhouse, R.A.

during the progress of the works, which are generally to a larger scale, and some of them full size. Thirdly, other drawings for work, the provision for which has been made in money or material.*

Section B.—SCALES TO BE OBSERVED.

104. For the general or contract drawings it is customary to adopt a scale of $\frac{1}{8}$th of an inch to the foot. They consist of—(*a*) Plan of every floor, and of the roof. (*b*) Elevations of every front and of those portions of external walls not shown in the sections. (*c*) Sections, taken in part or whole through all those portions of the design, which from a different treatment require elucidation, including those which show the flues or chimneys.† These sections are lettered A B, C D, etc., and the lines on which they are taken should be shown on the plans, and the section letters should be so placed as to read *the right way up* as the spectator looks at the drawings to see which walls the sections represent.

CLASS A.—PLANS.

105. In addition to plans of every floor and of the roof: in special cases it is necessary to add a plan of foundations and footings, and a block plan showing the relative position of the building to its surroundings; the latter is generally drawn to $\frac{1}{16}''$ scale, and has the position and dimension of the drains indicated on it, otherwise these are shown on the ground floor or basement plan. It will be found an advantage to have a special plan to $\frac{1}{8}''$ scale, made in outline, on which not only the soil drains should be shown, but also those intended to carry the rain-water (to tanks, if required), the water supply, hot and cold water services, wastes, and gas; these can all be indicated in lines of various colours: brown for soil drains, blue for rain, green and yellow for cold and hot water services (the latter with arrows to show flow and return), violet for wastes, and red for gas. The exact position of all these pipes is not always determinable till the completion of the work, when a revised plan of the main floors should be made with the amended direction of all pipes shown. The line should be a continuous one if below the floor, and be dotted if carried over head.

106. Although a scale should always be set out on every drawing, it is better not to trust entirely to this, but to mark in figures the calculated dimensions clearly and distinctly throughout, both inside and outside. All internal doors, with their width and perhaps their height, and also the width of chimney openings, should be figured on the plan. It is better not to indicate the position of every joist and trimmer, as it tends to

* There is no doubt that it would be a great advantage in many cases if it were possible to include some of the last class among the contract drawings, as the obtaining further estimates after the commencement of the works invariably leads to unforeseen Extras, owing to an incorrect estimate of their original value, or to a subsequent expansion of ideas.

† The position of fireplaces in the wall, behind those actually shown in elevation, should be indicated by dotted lines, as also the flues, unless there be two back to back, in which case the elevation of both sides of chimney jamb must be given.

confuse the plan, but the direction of their bearing should be shown by lines in brown ink, and their scantlings should be figured thereon, their distance apart being stated in the specification. All fittings which form part of the contract should be shown on the $\frac{1}{8}''$ scale drawings, at all events on the plan, as also the doors, and the way they are intended to open. This is generally regulated by the position of the fireplaces in sitting-rooms, and in bed-rooms by the position of the beds; the latter, therefore, should always be shown in pencil on the plan, but not necessarily traced for the contractor, though this sometimes is an advantage for other purposes, such as position of bell-pulls, gas-brackets, etc.

CLASSES B AND C.—ELEVATIONS AND SECTIONS.

107. In the elevations and sections the leading heights should be figured "floor to floor;" it is inexpedient to figure the heights "floor to ceiling," as these vary according to the depth of the floor joists. The heights of windows or doors (external) should not be figured on small scale drawings, but should be left to the larger scale drawings, on which the jointing in brick or stone with which they would have to range is shown. Unless a skeleton roof plan is given, the scantling of the roof timbers should be indicated on the sections.

108. For buildings of small size or of simple design, a $\frac{1}{4}''$ scale drawing will sometimes save $\frac{1}{2}''$ scale details. For alterations and additions to a house the same scale ($\frac{1}{4}''$) is also better.

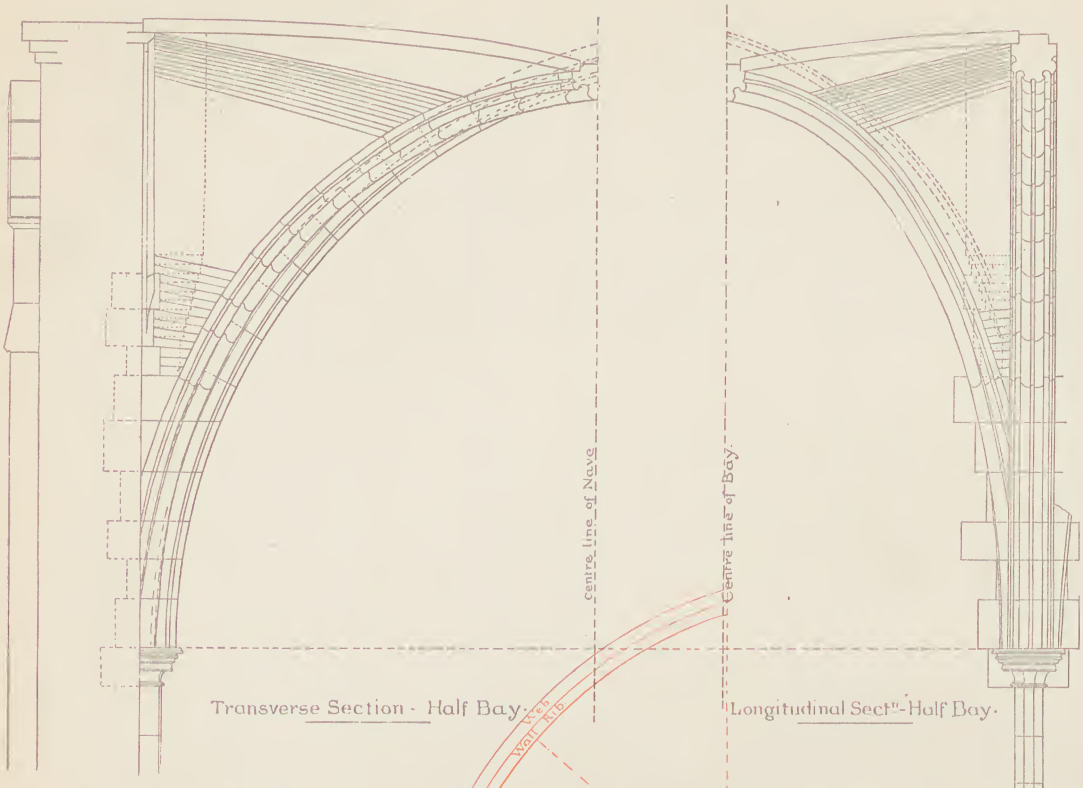
109. Although the $\frac{1}{8}''$ or $\frac{1}{4}''$ scale general drawings, together with the specification, are sufficient to show clearly the architect's intention with respect to the simpler classes of building, it eventually saves time and trouble if they are supplemented by $\frac{1}{2}''$ scale drawings. These ought to be prepared in time to form part of the contract, if there be any architectural features or special treatment in the construction: they are invaluable to the quantity-surveyor, whose task is simplified and rendered more accurate when taking off the dimensions; and they record the architect's intentions more clearly, and lessen the chance of dispute with the builder at the close of the work. The $\frac{1}{2}''$ scale drawings include details of one or more bays of the work, according to the variety of the design—with sections of the same showing footings and foundations —plans of windows at every level,* and sectional lines through mouldings—the setting out of vaults,† arcades, porches, windows, and doorways, details of such features as towers and spires—and generally all features of special design in stone, brick, or terra-cotta—iron roofs, girders, stanchions, and ironwork generally—the framing of the timbers in the roof (framed partitions are generally given to $\frac{1}{4}''$ scale)—staircases

* See illustrations of Woodford Church, and Messrs. John Greenwood and Son's warehouse, by Mr. Rowland Plumbe (Plates 7 and 8).

† See Plate 10, illustrating the setting out of the vaulting in the nave of the church of St. Michael and All Angels, Croydon, J. L. Pearson, Esq., R.A., architect; and the vaulting of the English Church at Rome, by the late George Edmund Street, Esq., R.A.

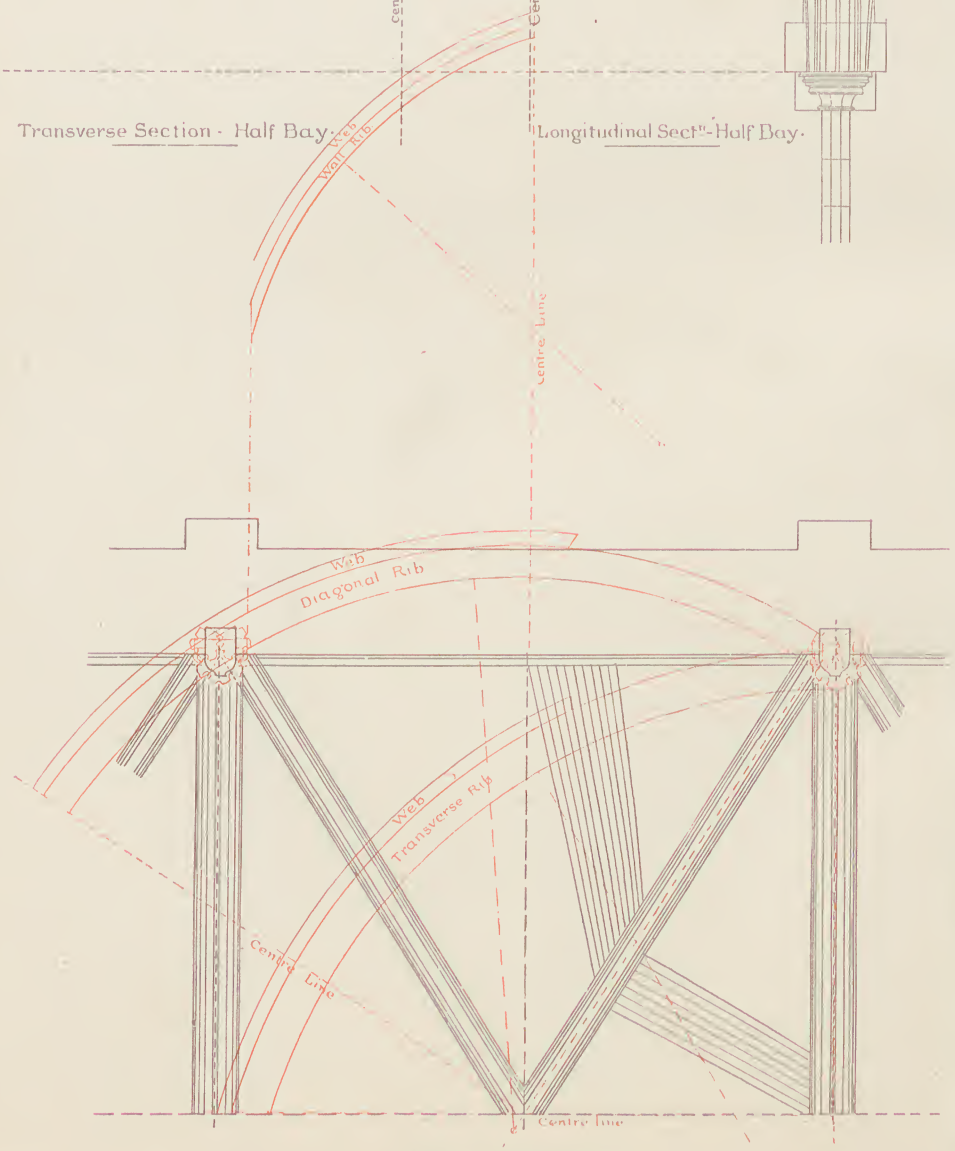
Church of S. Michael and All Angels · Croydon ·
Detail of Vaulting over Nave.

John L. Pearson R.A. Archt.



Transverse Section - Half Bay.

Longitudinal Sectn - Half Bay.



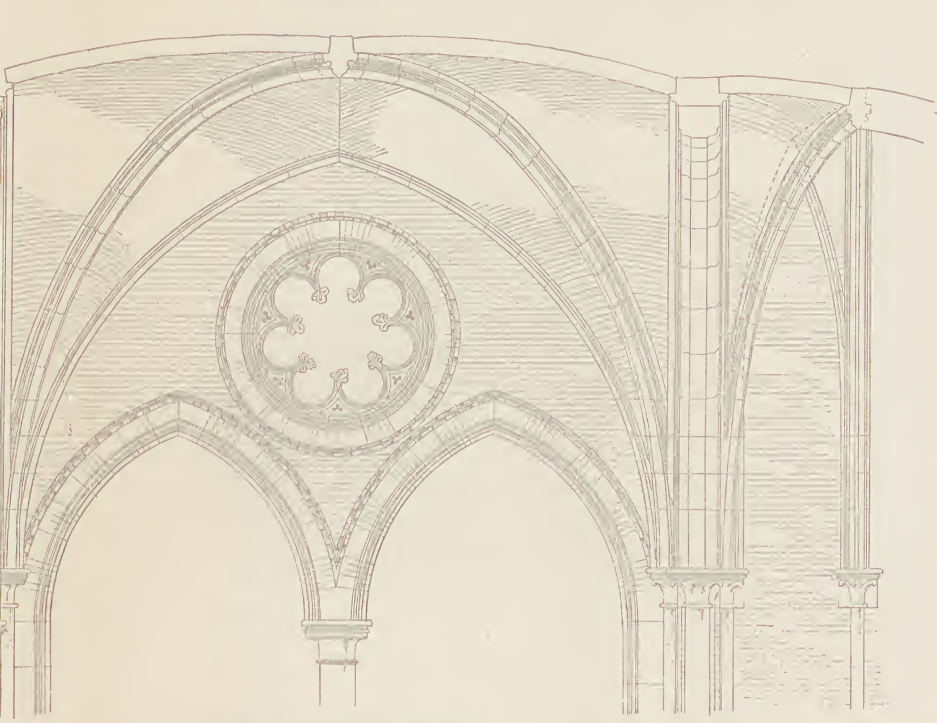
Plan - Half Bay.

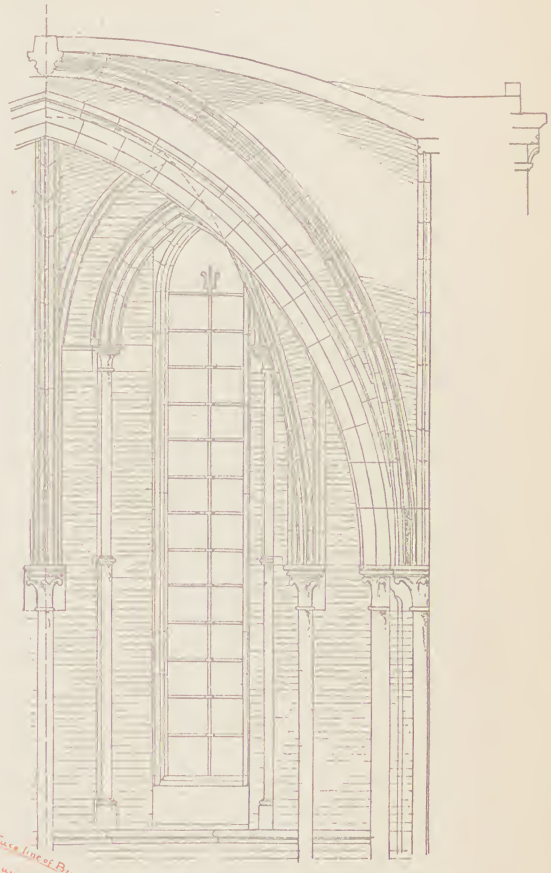
English Church Rome

George Edmund Street R.A. Architect.

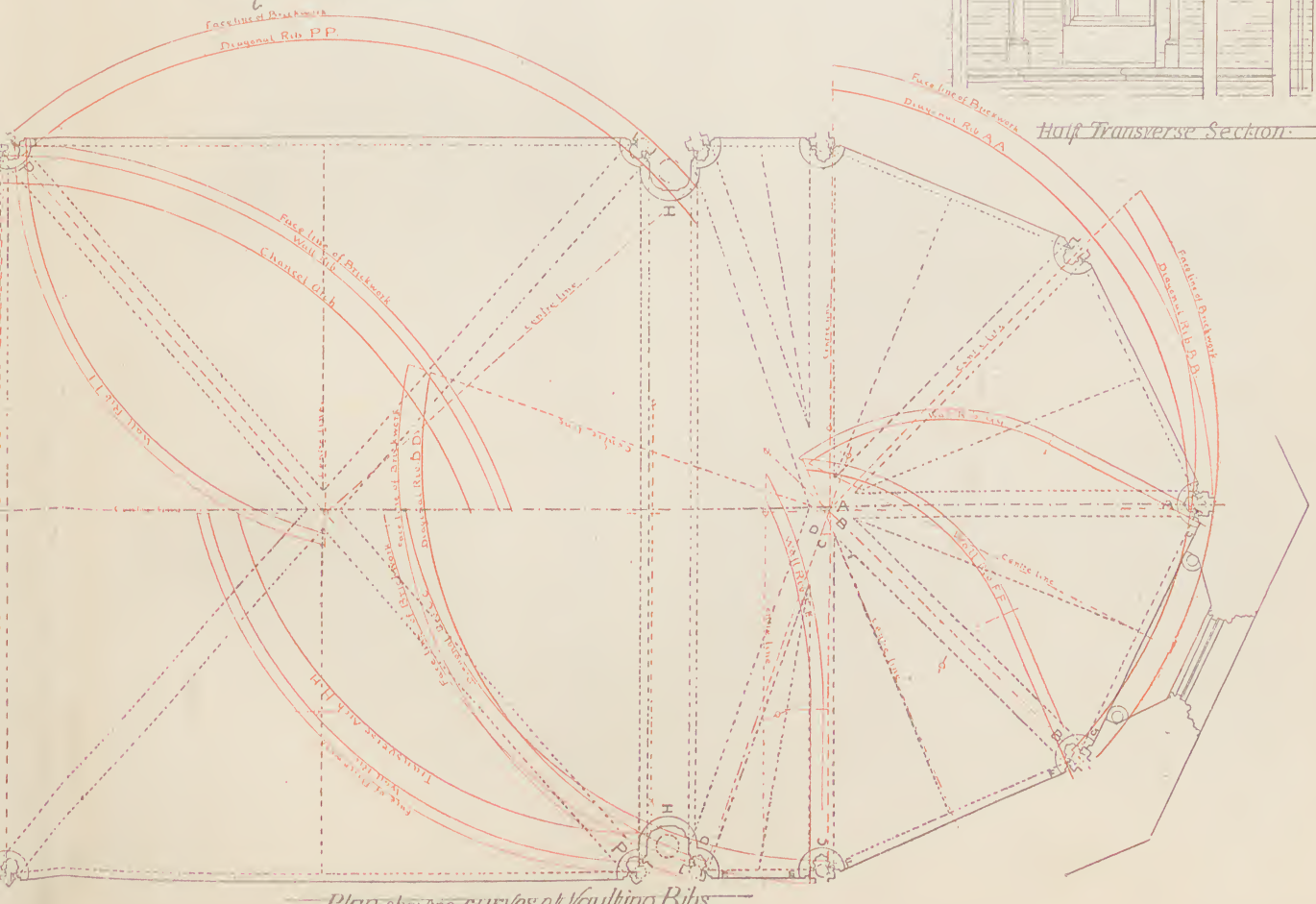
Details of Chancel Vaulting.

0 0 0 1 2 3 4 5 6 7 8 9 10 20 Feet.





Longitudinal Section


Face line of Brickwork
Diagonal Rib P P.
Face line of Brickwork
Diagonal Rib A A
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Chancel Arch
Centre line
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Diagonal Rib B B
Wall Rib
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Face line of Brickwork
Diagonal Rib D D
Face line of Brickwork
Transverse Arch D D
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Diagonal Rib F F
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Diagonal Rib E E
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Transverse Arch E E
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Diagonal Rib G G
Face line of Brickwork
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Diagonal Rib O O
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Diagonal Rib R R
Face line of Brickwork
Transverse Arch R R
Face line of Brickwork
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Centre line
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Wall Rib
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Diagonal Rib S S
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Transverse Arch S S
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Wall Rib
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Diagonal Rib T T
Face line of Brickwork
Transverse Arch T T
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Face line of Brickwork
Diagonal Rib U U
Face line of Brickwork
Transverse Arch U U
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Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib V V
Face line of Brickwork
Transverse Arch V V
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib W W
Face line of Brickwork
Transverse Arch W W
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib X X
Face line of Brickwork
Transverse Arch X X
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Wall Rib
Centre line
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Wall Rib
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Diagonal Rib Y Y
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Transverse Arch Y Y
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Diagonal Rib Z Z
Face line of Brickwork
Transverse Arch Z Z
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib A A
Face line of Brickwork
Transverse Arch A A
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib B B
Face line of Brickwork
Transverse Arch B B
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib C C
Face line of Brickwork
Transverse Arch C C
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib D D
Face line of Brickwork
Transverse Arch D D
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib E E
Face line of Brickwork
Transverse Arch E E
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Wall Rib
Centre line
Face line of Brickwork
Diagonal Rib F F
Face line of Brickwork
Transverse Arch F F

in wood or stone—doors, windows, chimneypieces, and fittings generally—church furniture, etc.

110. When the joinery is of any special design it is advisable to make the drawings to 1″ or 1½″ scale, and the same rule applies to pulpits in stone or wood, and to such features as fonts or reredoses in stone, when the scale of the detail requires more elaboration than the ½″ scale drawings could give.

111. Sometimes, as in canopy or screen work, it is necessary to draw out portions of the design full-size, otherwise it will be impossible to obtain the real "feeling" of the work; in such cases it is better to make the 1″ or 1½″ scale detail a key drawing, with letters indicating the portions drawn out full-size; sectional lines should be freely given, and occasionally perspective sketches of portions of the detail will assist the carver or modeller in understanding the intentions of the architect.

112. A quarter-full-size drawing is useful to judge of details of mouldings in stone or wood, in all cases to be supplemented by full-size contours, as it is unsafe to allow the workman to set these out from the smaller scale.

113. In dealing with terra-cotta it will be found better to obtain the "Shrinkage scale," and to draw out the details of the terra-cotta to the full-size to allow for shrinkage, otherwise the modeller will have to enlarge the ordinary full-size drawing, and in so doing may possibly lose some of the character and feeling it possesses.

114. As a general rule it is always advisable, after the larger scale drawings have been made (if important changes have been introduced) to reduce them to the smaller scales, and work them into the general design, whether it be to ⅛″, ¼″, or ½″ scale.

115. All unusual scales, as $\frac{3}{16}$″, $\frac{1}{6}$″, or decimal scales, should be avoided, as they frequently lead to errors; and half-full-size details are to be generally condemned, as misleading.

116. Contract drawings should always be inked-in, coloured, and figured. Alterations made after the signing of contract should be on a special drawing or tracing, or on a flap; if put on the contract drawings and agreed to by the builder, they should be indicated in red lines, as evidence of the change, and initialled or more fully stated as alterations.

Section C.—COLOURING OF MATERIALS.

117. In the tinting of working drawings it is customary to employ various colours; in this the artistic effect should be of secondary importance, the object being simply to distinguish different materials for the instruction and guidance of the quantity surveyor, contractor, and workmen.

118. It is of importance—Firstly, that the colours should be those found in the ordinary colour-box. Secondly, that the colours should, as far as possible, be unmixed, because it is difficult to obtain the same gradation of tone in subsequent mixing. Thirdly, that as far as possible the colour employed should be in harmony with the

colour of the material indicated (for instance, it is a mistake to use bright blue for stone, because it leads to contrasts of effect in the drawing which will be wanting in the executed building, and is therefore deceptive). And fourthly, that the colours used should be harmonious one with the other; the employment, for instance, of bright carmine for sections of walls, and Indian yellow for woodwork (both rather violent and crude colours when used unmixed), should be avoided.

119. The following is a list of the colours which seem to be generally accepted in most architects' offices:—

Stone*	Raw umber.
Paving and hearth stones....	Light Payne's grey.
Terra-cotta	Burnt umber.
Brickwork†	Venetian or light red.
Tiles	Venetian or light red, with admixture of a little yellow.
Fir and deals (unwrought)‡	Yellow ochre.
Ditto (wrought) ...	Burnt sienna.
Oak §...	Warm sepia.
Mahogany	Brown madder.
Walnut	Ordinary sepia.
Slate roofs	Indigo (tempered with yellow for green slates, and carmine for Welsh slates).
Plaster work (indicated in sections only) ...	Payne's grey.
Iron ‖	Prussian blue.
Glass¶	Mottled cobalt.
Brass	Indian yellow.
Copper	Indian yellow, with admixture of Indian red.
Concrete	Mottled grey and raw umber.
Cement	Burnt umber.

It is sometimes found an advantage to be able to note on the drawings such portions of the brickwork as are intended to be built in cement, thus supplementing the

* If there be more than one variety of stone employed, or if some difficulty be experienced in distinguishing ashlar and rubble work, one or the other may be left uncoloured, or light Payne's grey employed for the occasion; a stone of distinct colour, as red Mansfield, or some of the blue stones, may be tinted pale light red or blue grey, provided care be taken not to assimilate it too much to the tints used for brickwork and roofs.

† Some architects prefer Indian red for walls, and use light red for tile roofs.

‡ In plans it is generally found more convenient to tint the wood floors (although wrought) in yellow ochre, so as not to interfere with the colour of the fittings in light burnt sienna (see Plate 9).

§ The number of woods which may be employed is so great that colours could not be depended upon to distinguish them all; we have confined our list to those most in use.

‖ If it be necessary to distinguish between cast and wrought iron, the latter may be tinted emerald green.

¶ In elevations cobalt is of too light a colour to give the proper relative effect to the windows, and a mixture of black and Payne's grey, gradated, if possible, is better.

description in the specification. This can be easily done by passing a light tint of indigo over the brickwork (already coloured), with a note on the margin of the drawing.

120. The sectional parts should all be in darker tints of the above colours, except in the case of fir and deals, which are usually tinted in burnt sienna, yellow ochre being too light a colour. Ironwork, joists, and girders also may be tinted vermilion. Black is used to represent old work, and a pale wash of carmine will be found useful to tint over those portions of the sections the construction of which it has not been found convenient for the moment to determine, in preliminary sketches for instance.

121. It will be noticed that some exceptions have been made to the rule before suggested (par. 118) to use unmixed tints; the slight admixture in each case, however, even if subsequent mixtures differed slightly in the tone produced, would not be of much importance.

122. The application of the colours here suggested is shown in the illustrations given (Plates 7, 8, 9), so far as the $\frac{1}{2}''$ scale drawings, and those of less dimensions, are concerned. In the larger scale drawings and full-size details it is not the custom to indicate the sectional parts of the full colour throughout; a paler wash is passed over the section, and the outlines or contours are strengthened by a darker line of colour; in the case of woodwork the sectional parts are hatched diagonally with lines of the same colour, the direction of the lines generally following the grain of the wood. The grain may be shown *in pencil*, but the difference between different framings should be shown by inclination of hatching.

Section D.—REPRODUCTION.

123. The reproduction of working drawings for the contractor and clerk of works is usually effected by tracing them either on tracing paper or linen.

124. When several copies of the contract drawings are required, it is customary to have them photo-lithographed, or traced on lithographic tracing paper and transferred to stone, from which a large number of copies can be taken.

125. Another method of reproduction which has of late been resorted to is the Ferro-prussiate process. The Ferro-prussiate is a chemically prepared paper which changes colour on its exposure to light. A tracing of the drawing required to be reproduced is made on either linen or paper, laid on the Ferro-prussiate paper, and exposed to the light (a sheet of glass being laid over to keep it in position); the paper changes in colour in those parts which are not protected by the lines, and assumes various tints, according to the length of exposure. The time required for exposure varies according to the amount of light; on a fairly bright day, from twenty to forty minutes will suffice; in dull weather, the whole day or more. Frames are made to hold these drawings with double-hinged backs, so that the progress of change can be ascertained without shifting the drawing, by lifting up one side. When the

requisite colour is arrived at, the print is fixed by washing it in water for a few minutes, when the portions exposed to the light come out a light blue, and those protected by the ink lines on the tracing wash out white, the result being a drawing with white lines on blue paper. For ordinary purposes this is considered to be sufficient; but if it be found desirable to have blue lines on a white ground, so that the colours of the materials can afterwards be laid on, it will be necessary to obtain a negative first by the use of transparent Ferro-prussiate paper; then printing a second time through this, a drawing with blue lines on white ground can be obtained.*

126. The advantage of the process lies in the fact that small drawings (imperial size or less) can be printed in the office, and it therefore becomes less expensive than reproducing by photo-lithography.

SECOND DIVISION.—COMPETITION DRAWINGS.

SECTION A.—PLANS, ELEVATIONS, AND SECTIONS.

127. Competition drawings differ from working drawings chiefly in the tinting of the *plan* and section. The walls in them are generally coloured in monochrome, black, or chocolate, no attention being paid to the material, whether stone, brick, or wood. Occasionally in large plans it is the custom to separate the various departments of a building by colouring the floors of rooms in different conventional tints. Thus in a hospital the rooms devoted to administration would be tinted pale carmine, the men's wards blue, and the women's yellow.

128. Unless specially prohibited, the elevations may be tinted in such a manner as to emphasise the several blocks of the building, and sometimes to show the relative ultimate effect if the structure be in brick. In all these cases a less heavy effect will be given to the tinting if the colours are gradated, the upper portion being the darker.

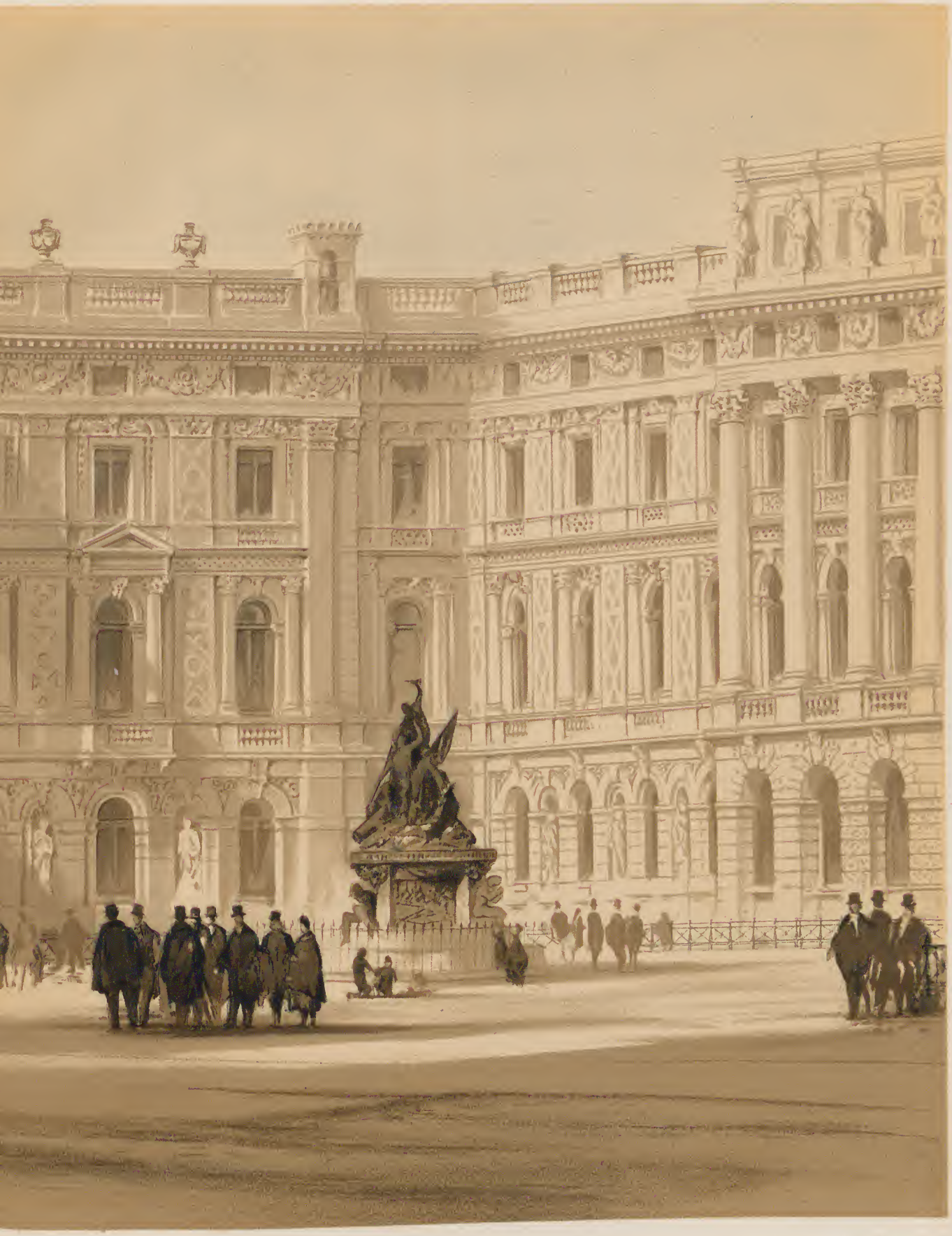
SECTION B.—PERSPECTIVES.

129. It is, however, in the perspective that the general effect of the building is best shown. Although, as a rule, it is found more convenient to have large perspective drawings prepared away from the office by architects and artists who have made it their special avocation, every student should acquire the power of making these drawings, that he may be able to judge of the effect of his own designs, and occasionally to work out small perspectives in the office.

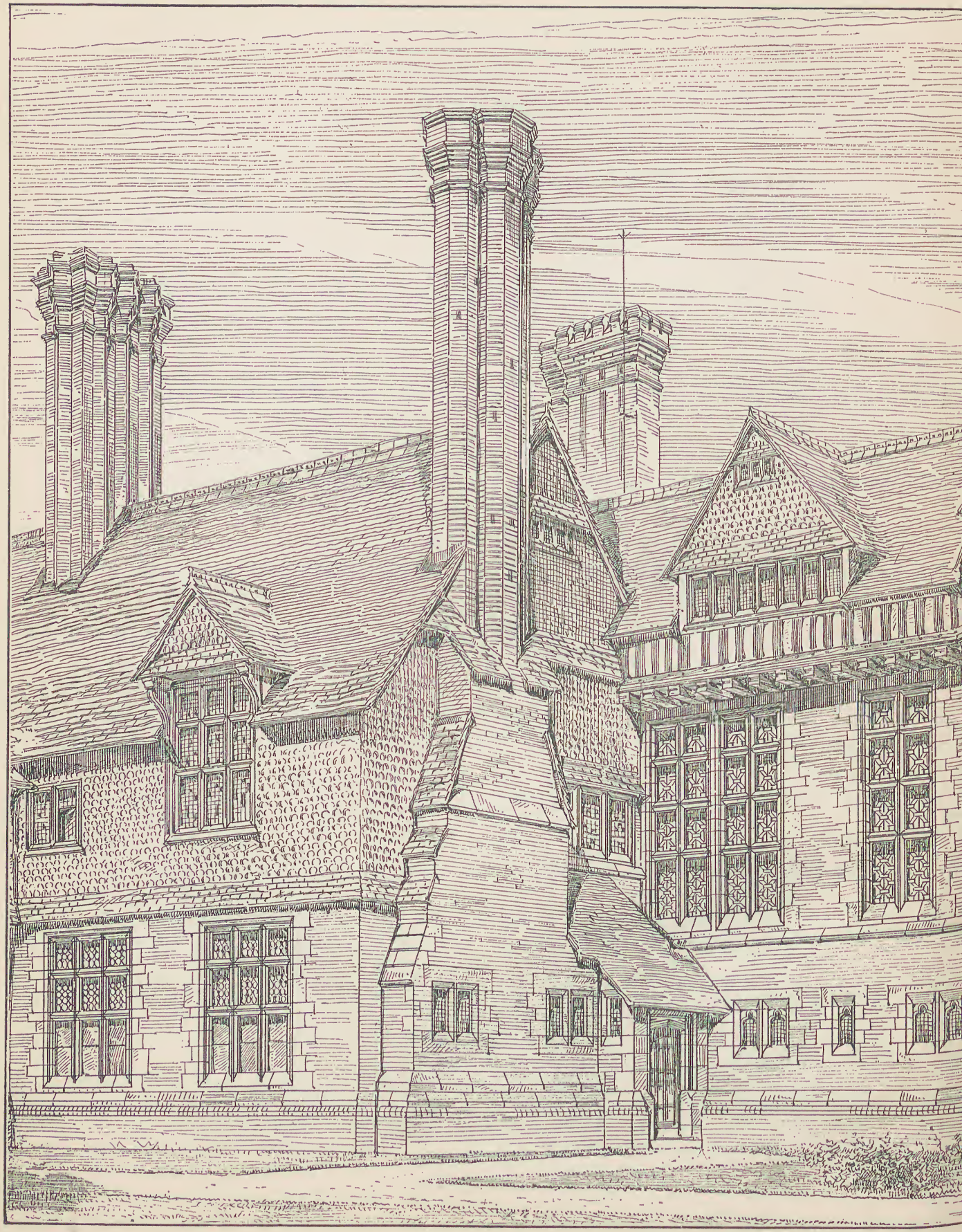
130. We have already observed that the purpose of the perspective drawing is to convey to a Committee or the Public some idea of the effect of the building when

* In both these cases the value of the result is increased by the firmness and blackness of the lines. Were it not for the difficulty of laying flat washes on tracing paper or linen, it might be possible to obtain two or three different degrees of tone by colouring the tracing with Indian ink or Payne's grey of various shades; pencil lines come out less strongly than ink, so that sectional parts could be hatched, and would show sufficiently in the print; short exposure or indifferent light might, however, defeat the object in view.

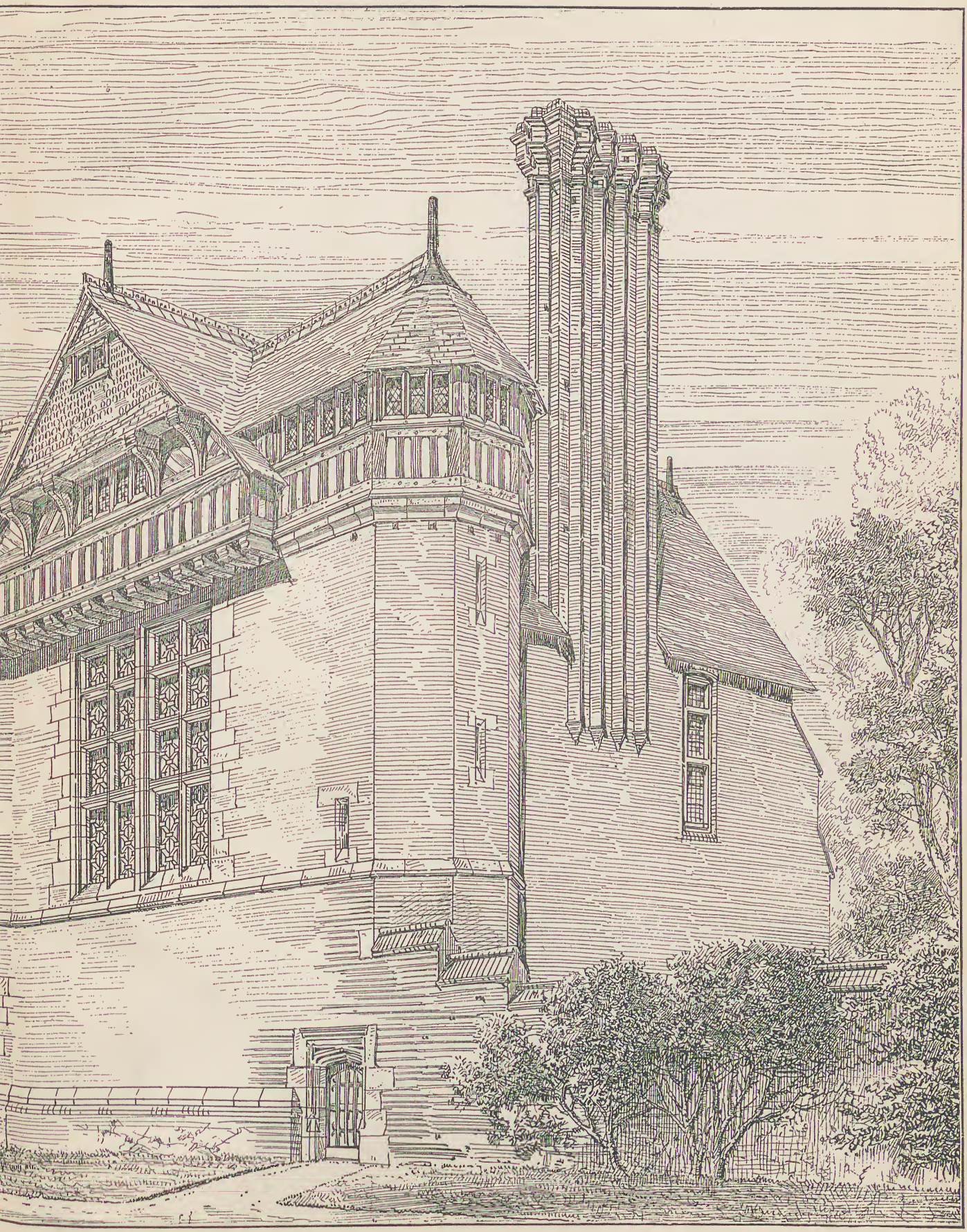
DESIGN FOR LIVERPOOL EXCHANGE.



The late Thomas Allom.



GRÆME'S DYKE, NEAR HARROW.



R. Norman Shaw, R.A

ALMSHOUSES, GUILDFORD.

Ernest George, F.R.I.B.A.

completed. In Competitions or for Exhibition, however, the desire is more than this; it is to set off the design *in an attractive manner*. The finish of the drawing and the method by which this is attained, whether in pen and ink or tinting in monochrome or colours, is consequently of some importance.

131. Attempts are sometimes made, in framing the conditions of Competitions, to restrict the use of colour or even of etching, but they are generally futile, for it is evident that the skilful artist who makes the drawing will attract a favourable verdict, whatever may be the medium he employs, or however simple. It might be a question for consideration how far competitors are justified in going to the expense of having elaborate water-colour or pen and ink drawings made only for a temporary purpose; but this consideration is one for themselves alone. It is difficult to lay down any law (except, perhaps, as regards size) which should draw the line between a simple or an elaborately-finished drawing.

132. There can be no doubt that the first object of the perspective drawing (viz., the representation of the building in perspective) would be sufficiently attained by leaving it in pencil or washing with a few tones of sepia; and the same drawing which, if etched in pen and ink, would take a month or six weeks to execute, could be tinted in sepia with far truer effect in a couple of days. We publish an illustration [see Plate 11] of part of a drawing executed by the late Mr. Thomas Allom, in competition for the Liverpool Exchange. The drawing measures 36″ × 18″, and the whole of it was drawn in and tinted in less than two days, the detail being all indicated with the brush.

133. The principal value to be attached to pen-and-ink drawings lies in the facility of their reproduction. We have already referred to the admirable series of illustrations which for many years have appeared in the professional papers, and if we take exception to them, it is more in the sense of the great expense involved in their preparation than in any want of appreciation of their dexterity and admirable draughtsmanship. The various processes for the reproduction of tinted drawings brought out during the last few years has overcome the difficulty of their illustration, so that for the purposes of publication, they are now placed more on the same level with pen-and-ink drawings. It is a great advantage when the architect is able to finish his perspectives himself, and much more interest is attached to the drawings when thus done. The late Mr. George Edmund Street, R.A., was accustomed always to ink-in his own perspectives, giving them an increased value; and the drawings of Mr. R. Norman Shaw, R.A. (who has contributed more than any other to the present high standard of pen-and-ink draughtsmanship), and of Mr. Alfred Waterhouse, R.A., will always command the admiration of the Profession and the Public.*

* The illustration given in Plate 12 of a house at Græme's Dyke, near Harrow, is an excellent example of Mr. R. Norman Shaw's draughtsmanship. In Plate 13, representing a portion of a drawing of some almshouses by Mr. Ernest George, the effect of the employment of a few washes of sepia is shown in the accentuation of the shadows and the bringing out of the high lights.

Section C.—COLOUR DECORATION.

134. It is a matter for regret that the internal decoration of rooms, such as the subdivision of the walls, and the scheme of colour and ornament to be applied thereon, is only rarely attempted in architect's designs; Prof. George Aitchison, A.R.A., being one of the few who has ever made a point of completing his architectural conceptions in this way. Both in France and Germany the decoration of rooms is considered to be part of the architect's work; and it is always shown in the sketch designs submitted to a client.

135. The student should not fail to sezie the opportunity of studying colour-decoration and its application to his design; for it is only when the three arts of architecture, painting, and sculpture are combined that a really fine work of art can be produced; and the manner in which, in France, the painter and sculptor are called in to co-operate in the work with their brother-artist, the architect, might more often be imitated in this country. It is, we believe, the want of confidence in the architect's power, and the entire absence of even an attempt to introduce the drawing of ornament, sculpture, or a scheme of colour-decoration, which leads the client frequently to consult a sculptor, painter, cabinet-maker, or decorator, to complete a work which from beginning to end ought to be subject to the individual control of the artist who first conceived the whole.

Part III.

OUTDOOR WORK.

The various classes of drawing described in this section have been grouped together because they are included, as a rule, in the student's outdoor work.

136. The practice of measuring is one of the best methods of acquiring a knowledge of the features of former architectural styles, and of impressing them on the memory. It is necessary, however, to bear in mind that to be able to design well it is not sufficient to have travelled far and drawn much. The forms which have been drawn must be applied to the student's design in accordance with the principles he has learnt from them. For this reason more is often learnt by measuring the whole of one important building than a number of fragments of different ones. On the other hand, the measuring of some one leading feature [such as one bay of a nave], as it is modified in several buildings, is of very great benefit.

137. It is necessary that the student should have some distinct object of study in view beyond the mere filling of his sketch-book, and even measuring may become after a time mechanical, unless the student combines with it the study of the construction and proportion of the building in question.

138. This mechanical tendency may also be counteracted by varying the work, and making either perspective drawings or sketches of the building as a whole or in detail. There are many cases when the object being that of recreation as well as study, the student may elect to take up some class of work other than measuring, involving less expenditure of time and money (as is the case when ladders or scaffolds have to be obtained), and the following list is suggested as constituting some of these classes of work:—

139.

(A) MEASURED DRAWINGS OF BUILDINGS OR PORTIONS OF SAME.

(B) PERSPECTIVE DRAWINGS.

(C) SKETCHES OF DETAIL AND GENERAL NOTES.

(D) WATER-COLOUR DRAWINGS AND SKETCHES.

(E) STUDIES OF COLOUR DECORATION.

(F) RUBBINGS OF BRASSES, PAVEMENTS, ETC.

Section A.—MEASURED DRAWINGS.

140. "Measure and plot on the spot" is an invariable rule which cannot be too strongly impressed on the student. Before commencing the measuring of any important work no pains should be spared to become thoroughly acquainted with the leading principles of its setting out, such as may be ascertained from a careful examination first; this becomes the more important where (as is the case with many ancient buildings) there are irregularities arising from settlements of any kind, or in the setting out of the plan.

141. In these cases it may be necessary to pursue the method employed by Mr. Neale in the measuring of St. Alban's Abbey,* and described by him in a paper read before the Architectural Association in 1879. Mr. Neale's method was to establish a good system of lines inside and outside the Abbey, with station-points at intervals, which could be used as starting-points for a detailed survey of each portion. To effect this he carried his principal skeleton line from east to west through the north doorway of screen. The length of the Abbey being so great, laths were fixed vertically at intervals on lumps of kneaded clay, and a telescope was used in ranging them from end to end. The position of the line was marked, and parallel lines inside the building were obtained by the use of a square 16 feet long in the arm. External lines were similarly laid down by the help of measurements taken through the windows, and diagonal lines were taken frequently to test the correctness of the setting out. Having once taken the general dimensions of these skeleton lines with Chesterfield's patent ribbon steel measuring tape, the building was measured in sections. Special scaffolds were erected to measure the various bays of the church, the stages in the interior being fixed at the levels of the caps of the ground story arcade, the triforium, and the clerestory. Special precautions were necessary in measuring the vertical heights, etc., on account of settlement.

142. As a general rule, all running measurements should be taken with tape. Diagonal dimensions should be obtained to check and tie in as much as possible, so as to reduce the skeleton lines to a system of triangulation, as is done in the Ordnance Survey. Any irregularities in the faces of walls (interior or exterior) should be checked from a straight line marked on the ground in front.

143. Before commencing to take the vertical dimensions a datum line, where practicable, should be run in chalk on the walls, etc., with a level, inside and outside the building, at a height of about four feet above the ground. If the latter be sloped, then auxiliary datum lines above or below may be drawn. The measurements must be taken from the lines upwards and downwards, and not from the ground or floor. Gables, porches, and other projections should be set out from a central plumb-line.

144. In the measurement of arches, the soffit or some leading moulding should first be selected, and then the following dimensions taken (see woodcut No. IV.): the

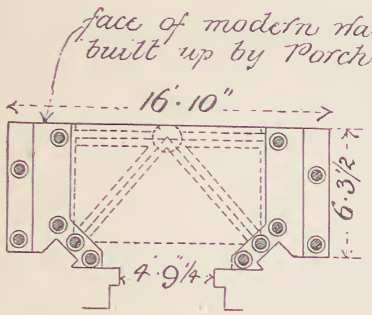
* Two plates (14 and 15) from Mr. Neale's drawings of the north-west porch of St. Alban's are here reproduced as types of good draughtsmanship.

MEASURED DRAWING.

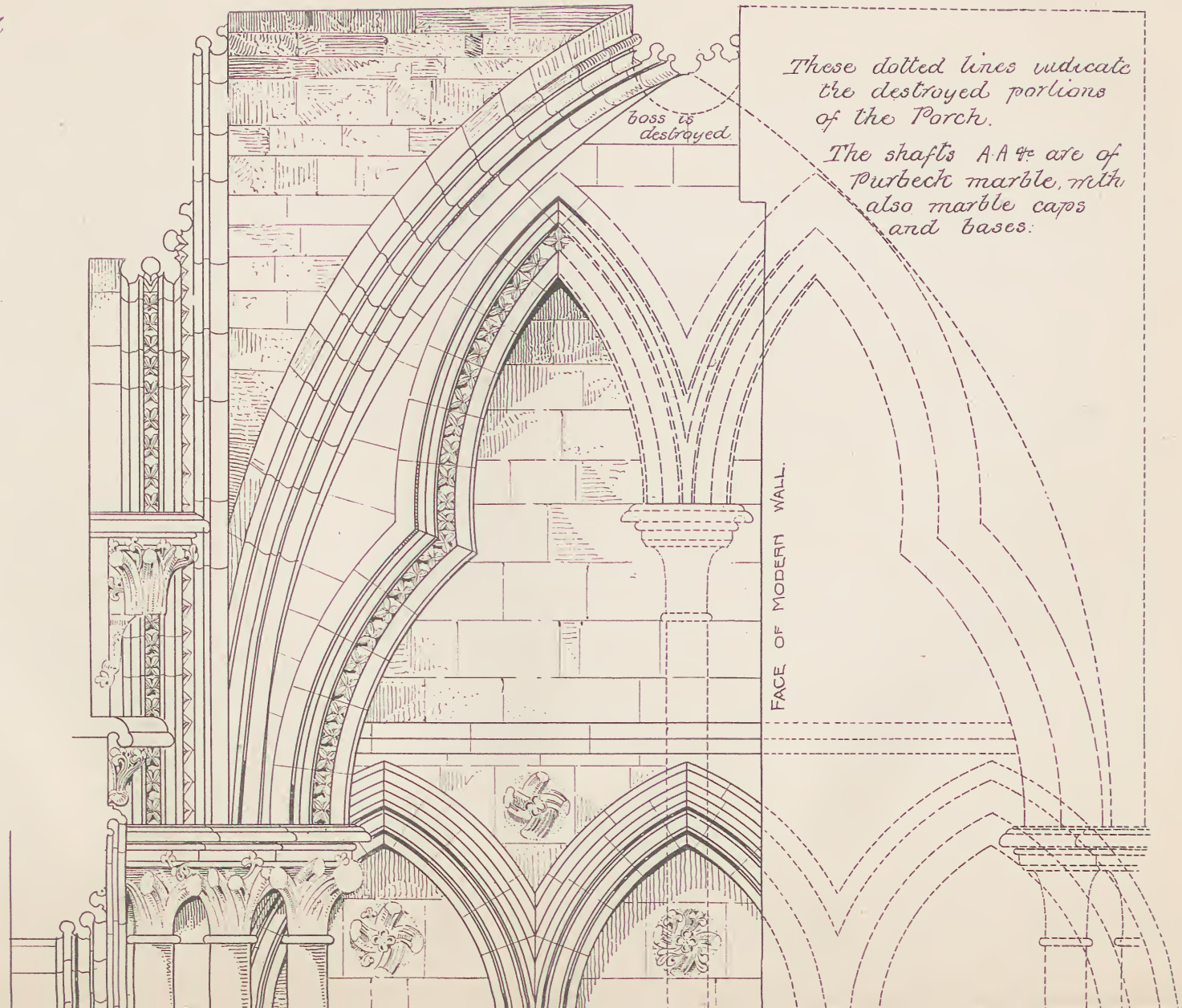
ST. ALBAN'S, WEST PORCH.

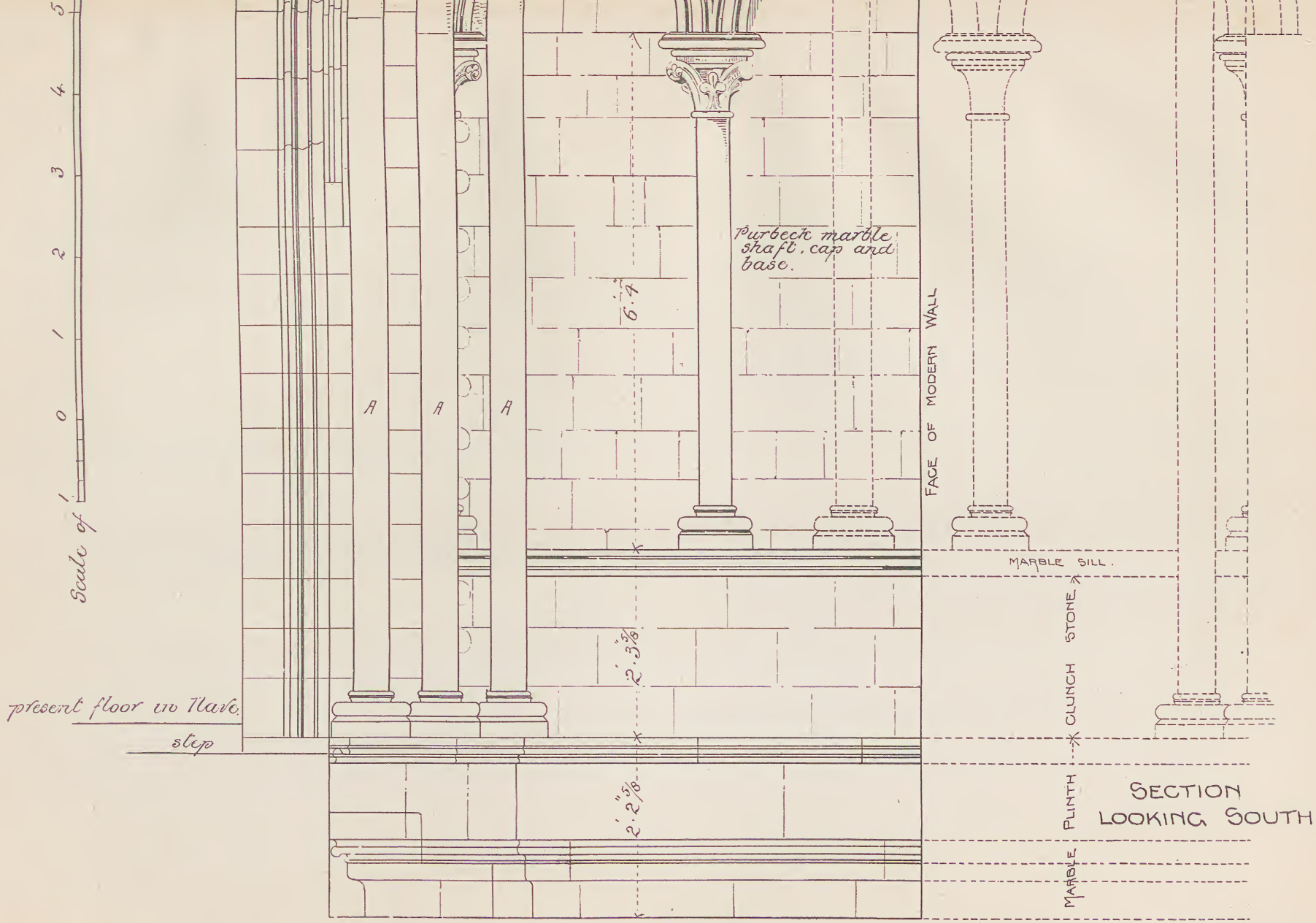
James Neale, F.S.A.

MEASURED DRAWING.



KEY PLAN.



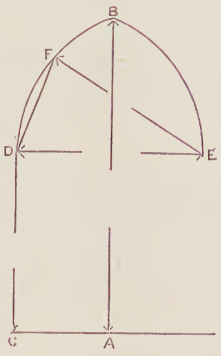


ST. ALBAN'S, WEST PORCH.

James Neale, F.S.A.

height from ground to apex, A B; height from ground to springing, C D; and the width across the arch, D E, taken between the same mouldings. To obtain the curve of arch, a

IV.



5 ft. rod, D F, should be set up (or straight-edge of less length as required) from the springing of arch, and measurements made from the top, F, to the springing on opposite side, E, care being taken to note if the springing of arch-mould is above or below the top of cap, or if any settlement has taken place. For the measurement of tracery, the general dimensions should be taken first, and then, if possible, rubbings of the tracery obtained on white lining paper.

145. Projecting courses, cornices, and capitals are best measured by holding up a plumb-line at greatest projection, and taking offsets therefrom, to the various members, and to wall or face of column. The vertical heights can be obtained by holding a spirit-level under lowest member and taking the perpendicular measurement, or by a set square if the column or wall face be vertical. The same process should be gone through in measuring bases.

146. For measuring shafts and small projections, calipers should be used, and if the joints of the two-foot rule are fairly stiff, it can be used to obtain dimensions under 12″. For larger shafts a thick copper wire can be bent and used as calipers. The exact dimension of detached circular columns can be measured by taking the circumference with a tape and dividing by 3·14; if there are two or more columns of the same size this dimension can be checked by sighting through on both sides of the column.

147. Mouldings are measured by various methods. If they lie in several planes or orders, they are most easily measured with the help of a set square; in "Perpendicular" mouldings, where they frequently all lie on a chamfered plane, a straight-edge should be held across the profile, and the depths and widths measured; it is sometimes easier in these cases to stretch a piece of thread across the mouldings, tying it to pins, needlepoints, or small bradawls, and this system can sometimes be adopted in measuring doorways and arch-mouldings.

148. However numerous the measurements may be, it is often difficult to obtain

151. In measuring the height of the vault of a church, dimensions can sometimes be obtained by a person standing in the clerestory and holding a light rod, from the end of which a plumb-line is suspended to the floor of the church. If the vaulting be of a complicated character, with intermediary or lierne ribs, then a plan should be drawn in chalk on the floor of the church, holding the plumb-line at each point where ribs meet, marking them on the floor, and joining them by lines which will represent the plan of the various ribs. The height of meeting-point of ribs in each case must be measured subsequently. The measuring may be rendered easier by tying pieces of coloured ribbon to the plumb-line at distances of five feet, counting the number of the five feet divisions and measuring the odd length, viz., the distance from the last ribbon on plumb-line to the floor by a 5 ft. rod.*

152. It is sometimes convenient when drawing work in which absolute accuracy is not necessary, to use "squared paper" (paper ruled with lines $\frac{1}{8}$" apart), and if every eighth or twelfth line be darker in tone, it will facilitate the work. This paper is very useful in the measuring of flowing ornament in panels, or of furniture, church fittings, etc., when it may be inconvenient to draw them out on the spot with T and set square on a drawing board. It should not be used when there is much geometrical pattern [as in perpendicular work], and the general dimensions of height and width should always be figured, in order that the accidental missing out of a square may be detected and rectified.

153. There is a method of making approximately measured drawings which may occasionally be undertaken with advantage by those who have not the time or opportunity to pursue the accurate kind of work which we have just described, and which occasionally may be deemed sufficiently accurate to enable a student to obtain collections of plans or elevations for the purpose of comparison. The lectures given by the late Mr. George Edmund Street, R.A., at the Royal Academy, on the apsidal termination of cathedrals and churches, were the outcome of a series of "parallels of plans" which he had made of almost every important church in Europe. To have measured these all accurately would have been impracticable; by contenting himself, however, with measuring the piers and pacing their distances, centre to centre, he was able to plot approximately the plan of the east end of each, and this he supplemented by a large freehand perspective sketch of the choir as seen from its north or south transept.

154. The travelling students of an earlier date not only measured plans by pacing, but, before photography came in, the geometrical elevations (see Plate 16) and sections in a special manner which deserves notice. The student first measured a height of eight or ten feet from the base of the building up to some string-course or joint; he then retired to such a distance, that when he held up his two-foot rule perpendicularly at arm's length, the number of feet he had measured coincided with an equal number of half or quarter inches on the rule. He then raised his eye to some other well marked or

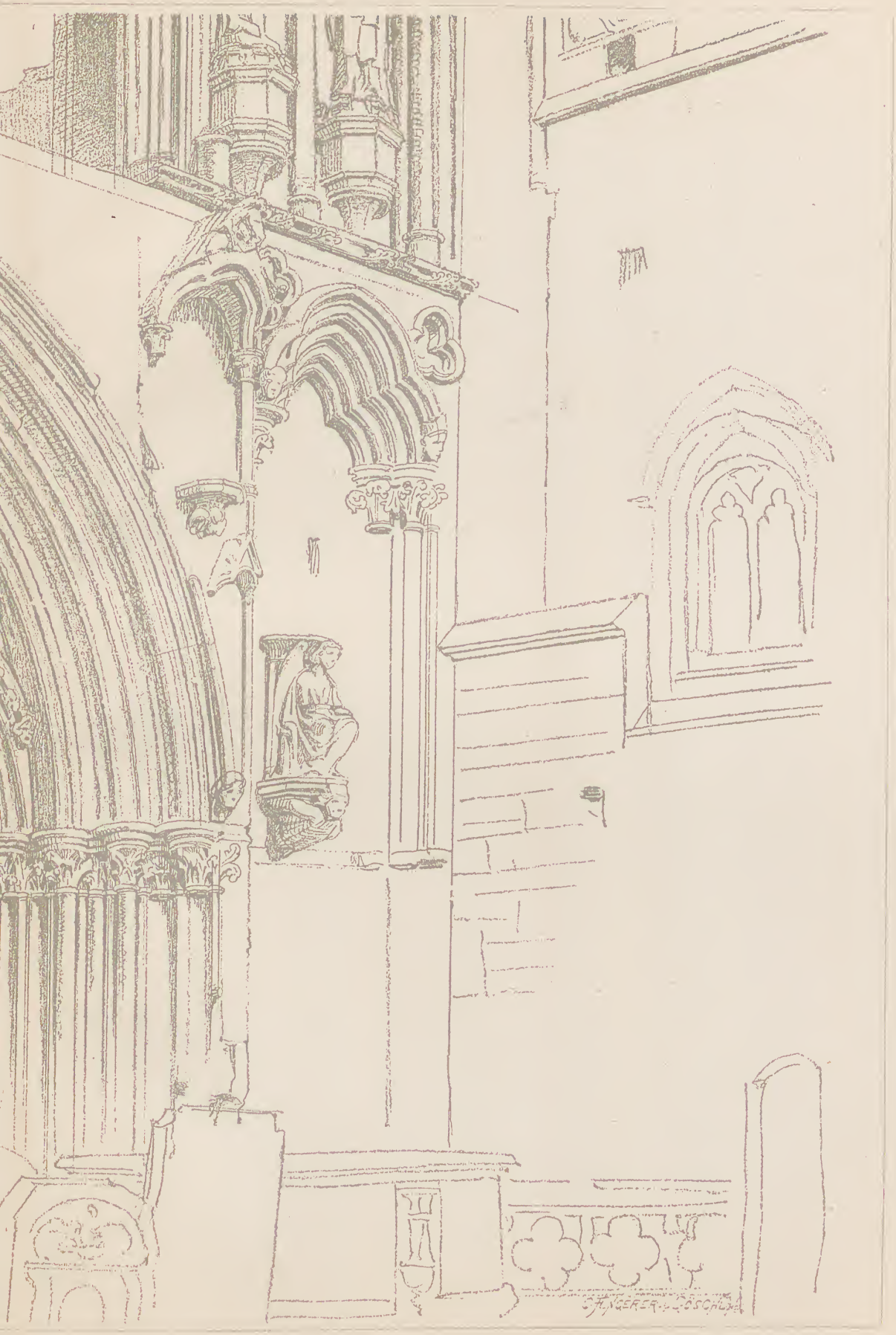
* This system was adopted by the author in measuring the cupola of St. Stephen's, Walbrook, the plan of a sectional part of which was mapped out on the floor, with approximate dimensions of the ornament on the panels.

LINE DRAWING IN PENCIL.

PALAZZO BARTOLINI.

The late Frederick Pepys Cockerell.

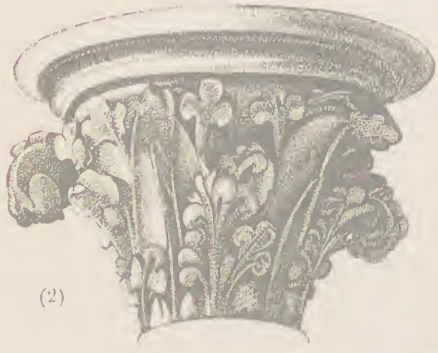
Crowland Abbey Porch.



The late Frederick Pepys Cockerell.

(1)

(4)



(2)

Capitals at Ely Cathedral.

(1) North side, Lower Arcade.

(2) North side, Lower Arcade.

(3)

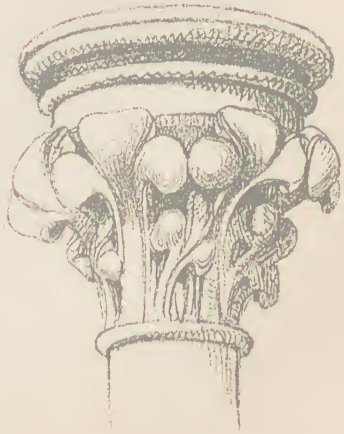
Capitals and Carving at Lincoln Cathedral.

(3) North-West Porch.

(4) Presbytery Aisle.

(5) Choir Aisle.

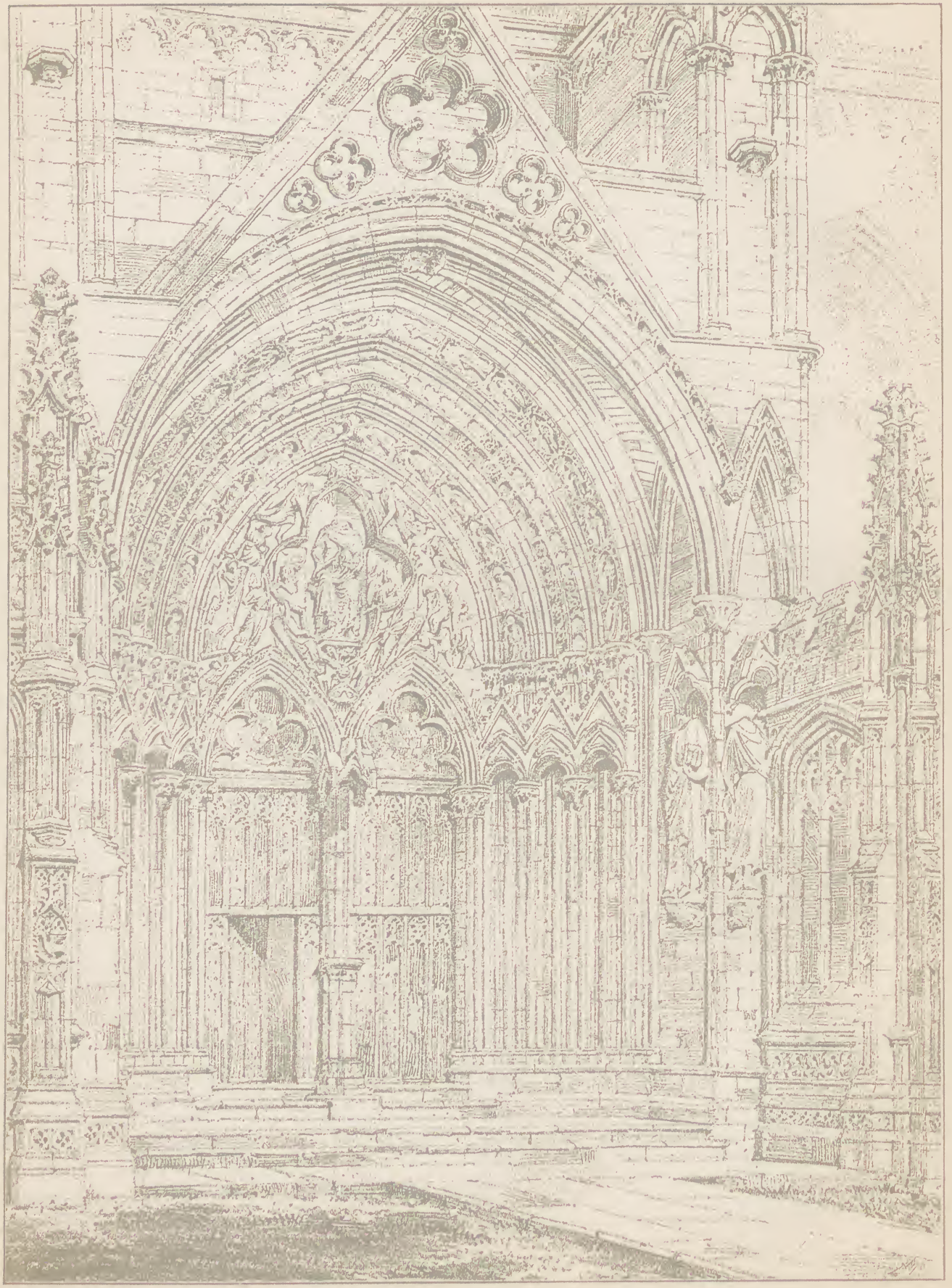
(5)



ST. GEORGIO, MAGGIORE.

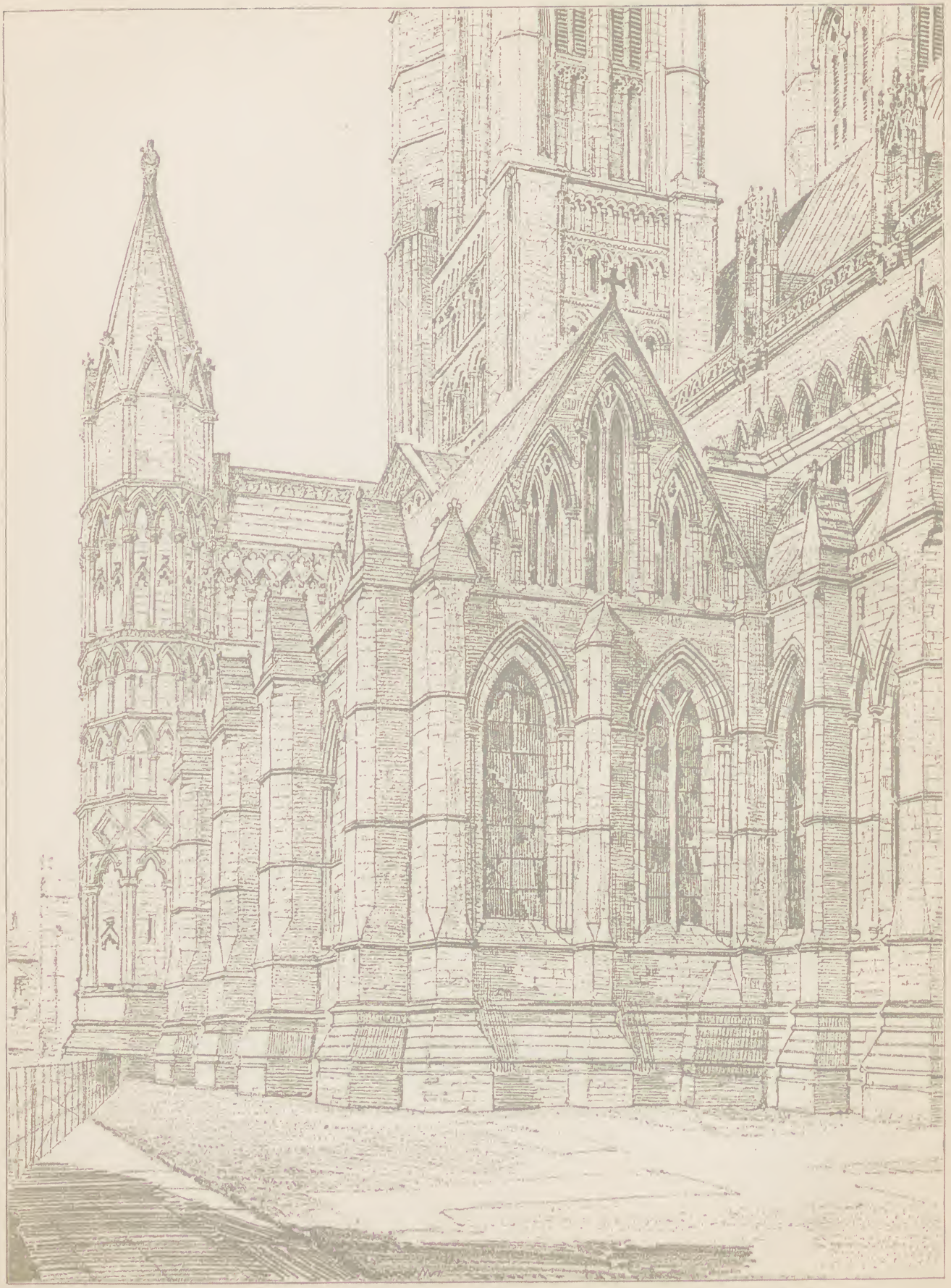
The late Frederick Pepys Cockerell.

PERSPECTIVE DRAWING, PENCIL.



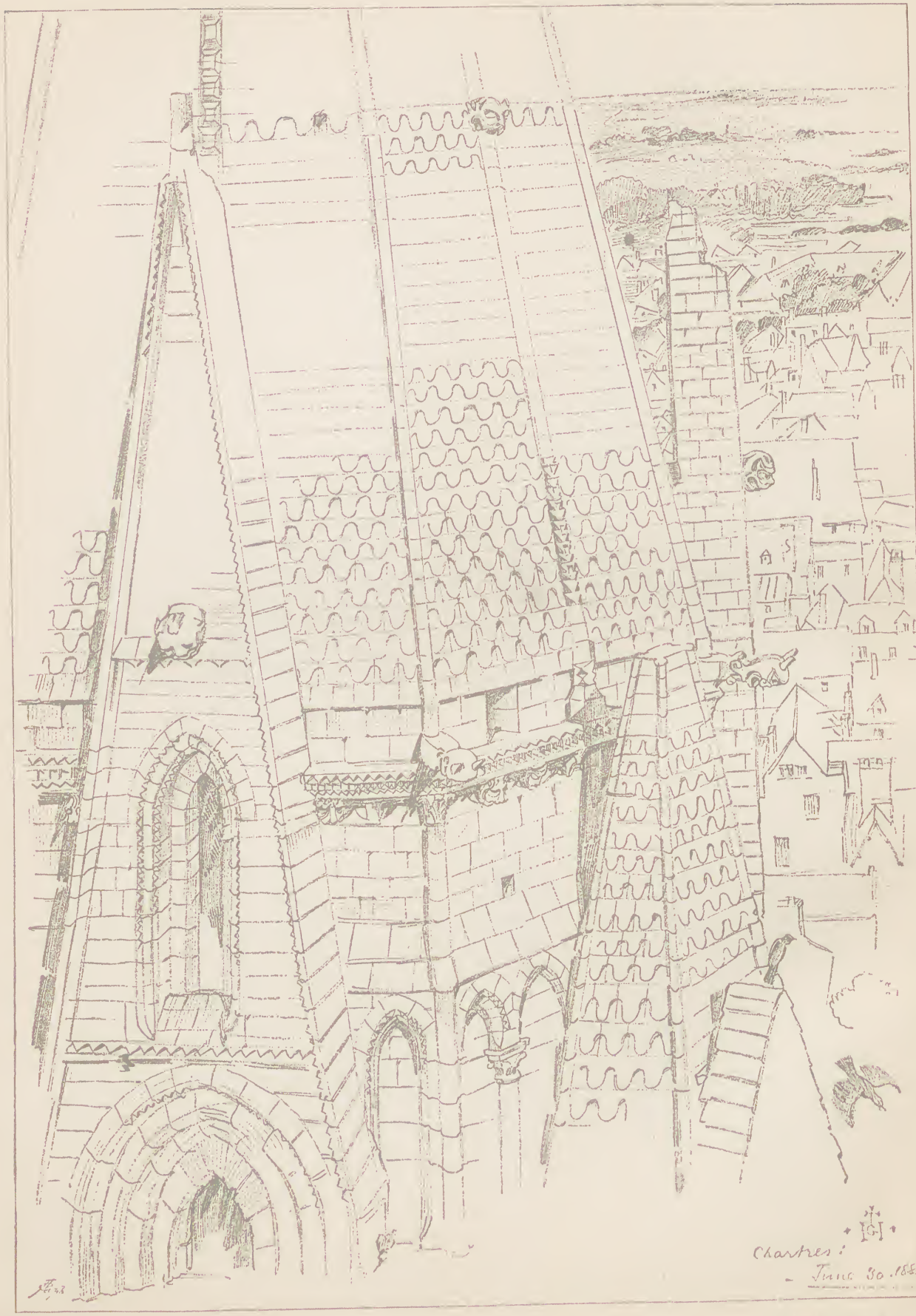
LINCOLN CATHEDRAL, SOUTH PORCH. *W. H. Bidlake, M.A.*

PERSPECTIVE DRAWING, PENCIL.



LINCOLN CATHEDRAL, SOUTH FRONT. *W. H. Bidlake, M.A.*

PERSPECTIVE DRAWING. PENCIL.



SOUTH-WEST TOWER, CHARTRES CATHEDRAL.

Gerald Horsley.

TRACERY IN SOUTH AISLE, COUTANCES CATHEDRAL. *Gerald Horsley*

conspicuous horizontal feature [*e.g.*, a cornice or string-course] higher up on the wall, and noted the increased number of half or quarter inches, as so many feet, to be added to the original eight or ten, giving the height of the second string-course from the ground. Then retiring further off until each foot of the building coincided with $\frac{1}{8}$th of an inch of his rule, it was possible to obtain with fair accuracy the total height of a building of three or four floors. It is of the utmost importance that the rule should be held absolutely vertical, which can be done by holding it parallel to a plumb-line. These approximate measurements can sometimes be supplemented or replaced by counting the joints of brick or stone and taking an average of the dimensions of those within reach. On the same principle it is possible to obtain the height of a tower or spire.

155. This approximate method should not be adopted if the student have time and the means of obtaining a ladder or scaffolds at his disposal, unless he has some other object in view. Sometimes he may find a scaffold erected for the purpose of repairs, and this opportunity should not be lost to take at least the leading dimensions.

Section B.—PERSPECTIVE DRAWINGS.

156. The drawings to which we refer in this section are those made on paper, mounted on a board or in a block, and in the execution of which both T square and set square are used. These drawings are set out with more care and accuracy than if they were intended only to practise the student's hand for the purposes of record or of study.

157. The various prizes offered by the Royal Institute of British Architects, the Royal Academy, and the Architectural Association, have called for the production of careful drawings of this class,* which are invariably drawn on Whatman's "hot-pressed," cartridge, or other smooth paper. It is necessary that there should be as little rubbing out as possible; the general proportions should therefore be carefully blocked in first, measuring by the pencil held at arm's length to determine the relative width of a bay or tower in comparison with its height, and subsequently the several horizontal and vertical lines; it may take a long time at first, but in the end will save trouble and rubbing out as well. The drawing will sometimes gain when the student draws in the vertical or inclined lines freehand, instead of using the edge of the square, as a too great regularity in the lines produces a hard mechanical effect.

158. In Part I. of this work we have laid stress on the great importance to be attached to the constant practice in freehand drawing of ornament as an elementary

* We are enabled to publish illustrations of some of the best drawings which have been made in the competitions for the Pugin and other Travelling Studentships, as also of some admirable examples executed by the late Mr. Frederick Cockerell, the most accomplished artist of his day, and these show better than we could explain in words the quality of draughtsmanship which should be sought for in this class of work. See Plates 17, 18, 19, from drawings by the late Mr. F. P. Cockerell; 20, 21, from drawings by Mr. W. H. Bidlake; and 22, 23, from drawings by Mr. Gerald Horsley.

means of study; its further development should be sought for by the student, when drawing from ancient buildings, in occasionally delineating (to as large a scale as his sketch block will admit of) the exquisite foliage which is found in early English work, and this of course should be drawn in perspective as it is seen. In the drawing of Italian and other detail in panels, the ornament should be drawn geometrically, and although in this case it is advisable to take the general dimensions, it is better not to trust too much to these, but as far as possible to draw with a free hand. The work originally was probably either carved direct or copied from a model in clay, it certainly was not designed on paper first, and therefore if every leaf be measured and plotted down, unless it is for the purpose of illustration (when extreme accuracy is desirable), the feeling of the subtle curves of the foliage and ornament will be lost, and one of the chief advantages in drawing it will be frustrated.

159. Our account of drawing in Perspective would not be complete without reference to the Camera Lucida, the use of which is much more prevalent among French than English architects. The instrument consists of a small prism of glass fitted in a metal case attached to a vertical rod, which is screwed to a table or small drawing board, on which the drawing paper is mounted. Looking vertically downwards through a small uncovered portion of this prism (which, by the way, is not triangular but four-sided, two of the sides being at right angles to one another, the other two enclosing an obtuse angle), the building or object to be drawn is reflected or transmitted on to the table, and the eye (the left eye, as the instrument is fixed on the left side of the table so as not to interfere with the movement of the right hand when drawing) not only sees the object reflected, but the point of the pencil when on the paper, and consequently with it the draughtsman is able to follow and draw the main lines of the reflected object. The instrument requires some practice at first in its use, and considerable experience in the fixing and in the arranging of the table horizontally. The vertical rod consists of three hollow tubes fitting one in the other; 1stly, to reduce the instrument to a portable size, and 2ndly, to allow of a small or large drawing being made. The position of the prism with reference to the table determines the station-point of the perspective view which is about to be made; with a small drawing it may be close to the table, with a large one farther off. About 30 inches is the greatest length of the vertical rod of an ordinary instrument. At this length the visual rays of the prism cover an area of about 20″ square, but a much larger drawing could be made with special contrivances.

160. Monsieur Viollet-le-Duc extended the value of the Camera Lucida by using it to obtain the relative dimensions of any large château or church he was about to restore. Having measured the plan and certain leading heights of the elevation, he was enabled by a series of outline sketches made with the camera to obtain the height of other features by calculation of the stone jointing, or by relative proportions; the approximate measurement of all the jointing, both horizontal and vertical, he also obtained from the camera drawing.

ANDRIEU, TOWER OF CHURCH.

Tracing from Sketch by the late Geo. E. Street, R.A.

161. In England the Camera Lucida is frequently used by painters to obtain the exact proportion of certain prominent features in their subjects, the details being filled in afterwards. In cases where it is intended to make a water-colour drawing, or where great accuracy or celerity is required, the instrument will be found to be of great value for sketching in the main features of a building. If too exclusively used, however, it tends to enslave the draughtsman, and therefore its employment cannot always be recommended.

162. As a rule, for the ordinary perspective drawing, a quarter imperial size sketch block is the most useful. Blocks with Whatman's "hot-pressed" or cartridge paper offer the best surface for drawing on in pencil, and the former is excellent for ink. The quality of hardness or softness of the pencil depends on the practice of the student and on the kind of paper used; and the rapidity with which paper imbibes moisture on a wet day requires sometimes a softer pencil to be used.

Section C.—PERSPECTIVE SKETCHES AND NOTES.

163. The great majority of students rarely go beyond the class of work cited in this section; their drawings are generally made in a note or sketch-book, the size of which varies according to the individuality of the student: some prefer a book measuring 6 or 7 by 4 inches (which can easily be placed in the pocket), or a note-book of even smaller dimensions; others are accustomed to use a quarto album, which admits of a drawing being made across both pages.

164. The most indefatigable sketcher of recent times (the late Mr. George Edmund Street, R.A.) used a book measuring 8 in. by $6\frac{1}{2}$ in., and invariably extended his drawing across the two pages; long experience, possibly, enabled him to so place his drawing that the fold in the middle did not materially interfere either with the effect of the drawing as a whole, or the proper vanishing of his perspective lines.* As he always drew freehand when sketching out of doors, *i.e.*, without the use of rule or compass, he contented himself with drawing only the leading lines, whether straight or curved, in such features as cornices, string-courses, vertical shafts, or arch mouldings; simply indicating the starting points of the others, and leaving it to the eye to supply their continuation; the result being that the sketch is not overlaid; there is not a line in his drawings which could be spared, and no more is indicated than absolutely necessary to convey a full idea of the feature portrayed. Mr. Street not only discarded the use of instruments, but of india-rubber as well; the greatest care, therefore, had to be taken in the setting out of his sketch, and long practice and accuracy of eye enabled him to preserve the scale throughout in his drawings; his great knowledge of detail of every kind of Gothic work allowed him to grasp at once the characteristics of any feature, and to delineate it in the fewest possible lines. In all cases when easily

* We publish a reproduction of a tracing (Plate 24) made of one of his sketches, by kind permission of his son, Mr. Arthur Street, which may be taken as an admirable example of a useful drawing.

obtainable Mr. Street noted the principal dimensions of the features he drew, whether sketched in perspective or geometrically.

165. There are not many students who can hope to dispense altogether with india-rubber, nor should we be inclined to recommend it; but on the other hand, when it is intended that the drawing should be left in pencil, the fewer the lines which have to be rubbed out the better, and if instead of covering the paper with a series of lines hastily sketched in, the student accustoms himself to suggest their direction by points only, short practice will enable him, when he has once placed these points correctly on the paper, to join them together with carefully drawn lines. Such a system of setting out requires more time than sketching in, the eye being raised two or three times to be sure that the point about to be indicated is correctly placed with reference to those already drawn, but in the end greater accuracy will be obtained, and the drawing will be more clear and sharp in its lines where the surface of the paper has not been destroyed.

166. Besides the block or sketching album, it is sometimes convenient to make use of a small note-book, which will be found of value to make a hasty note of features when there is no time to make a more careful sketch, or when (as in Holland and some Continental towns) the production of a larger sketch-book attracts a crowd of well-meaning, though inquisitive, people.*

167. When drawings are made on hot-pressed, cartridge, or other smooth papers, with a fairly hard pencil, and without shading, it is rarely necessary to fix the pencil lines, but with Whatman's "not" and rough qualities the drawing will be apt to rub, and some fixing solution should be employed; the material known as tragacanth gum (obtainable at a chemist's) is perhaps the best to use; there is not that unpleasant glaze which ordinary gum gives, and the drawing can be worked upon afterwards and even coloured, which, with ordinary gum or milk fixing, would be impossible.

Section D.—WATER-COLOUR DRAWINGS AND SKETCHES.

168. If one may judge by the portfolios of drawings brought home by those students who make tours either on their own account or as the holders of Travelling Studentships, the execution of water-colour drawings or even sketches is not considered now to be requisite; and although, on the one hand, the tendency to develop the powers of a water-colour artist is somewhat dangerous, on the other, to spend six months or a year in countries where colour is predominant, when the whole effect of a building is dependent

* The author of this book has been in the habit of using a small note-book stitched in paper cover, measuring 5 × 3½ inches, which is held by an india-rubber band in a leather case, and can be replaced when full of notes. The leather case has two pockets; in one of them is kept the plan of the route, with names of hotels or important buildings to be seen in each town; in the other is a piece of cardboard with the centre cut away, leaving a margin about half an inch on each side, the opening being proportional to the shape of the sketching block. By holding up this cardboard frame and looking through it, the student is enabled sometimes easier to judge how much of the view it is possible to include in any large drawing, and also whether it is advisable to make it upright or oblong.

on its relation to the sky and landscape, and to return without making even a note on the same, runs to the opposite extreme. In many cases, no doubt, this abstention is not voluntary, and is the result of an absence of training in the use of the brush, which, causing a failure in two or three attempts, leads to the colour-box being put aside altogether. If the province of the architect were limited to the designing and superintendence of a block of buildings subsequently to be handed over to the decorators, this neglect of colour might be understood. The work of an architect, however, can never be completed till he has not only conceived but superintended generally its colour decoration. If this be so, it is requisite to go through some training, by studies of colour decoration or by some other means. There is no doubt that to arrive at a highly cultivated standard something more than mere training, *i.e.*, an "eye for colour," is necessary; but on the other hand, a student (unless afflicted by colour-blindness) may, by constantly making studies from nature, gradually train his eye to recognise harmonies of tone, and not infrequently find schemes which may suggest to him a treatment in his own designs.

169. In support of this theory, some extracts from a paper read by Mr. J. D. Crace before a meeting of the Architectural Association in June, 1877, on "Nature and the Study of Decoration," are worth noting, coming as they do from an artist who not only seizes every opportunity of recording some of nature's phases in his sketch-book, but in his practical decorative work avails himself of the lessons learnt.

"All coloured decoration is in some sort borrowed from nature; sometimes the obligation is so direct, or so recent, that its recognition is simple, requiring no effort of thought. But this is less often the case with the general features of any decorative work than with special points of detail. The connection between some of the most valuable forms of ornament and their prototypes in nature is often to be traced with difficulty, sometimes not to be traced at all. And the scheme of colouring followed out in decorative work may often have been due to a passing impression on the artist's mind, produced by natural objects of natural phenomena, of the utilisation of which he has himself been probably, but partly, conscious. The result was none the less due to that habit of observation which every true artist is perpetually cultivating.

"What, then, are the lessons which the decorator may learn from nature? They are, of course, endless, and they are to be derived from every visible form of nature, whether it be in the domain of vegetable life with all its wonderful resources of flowers and foliage, or in the animal kingdom with its precious teachings from the most brilliant to the most subdued combinations of colour, and the most subtle adaptations of form; or the very soil we tread on, the pebbles at our feet, the rocks from which we build, and the water which reflects them all; or, lastly, from the atmosphere which we breathe, and which not only supplies us with a scale of the most exquisite delicacy of ever-varying tints, but with the phenomena upon which is based whatever knowledge we have of colour itself. From all these something may be learned.

"Another lesson to be learnt from the observation of landscape scenery is that of harmony of tone, which nature teaches us on a grand scale with every season. It is almost needless to dwell at length upon the beautiful adjustment of tone in the colouring which nature assumes at various periods of the year. In winter we have the many shades of browns, dull greys, and scanty low-toned greens of the woods and fields, harmonising with the murky greys and occasional pale grey blues of the winter skies. In spring, as the sky becomes brighter, the clouds of warmer, clearer, and more lilac tones, a beautiful change comes over the trees even before they actually put forth leaves.

"Summer advances; the foliage grows more dense, the greens darker and less bright. The meadows also seem less green, for they are in bloom; and the delicate feathery blossom, and the flowers of the sorrel, clover, or vetch, perceptibly affect the general hue. The various grains begin to ripen, and the more rapid evaporation, and the more intense light, give the distant hills a deeper blue.

"Autumn follows; on its brighter days the warm sunlight seems to touch everything with gold and crimson under the blue sky and warm grey clouds. But the skies darken, the sunlit gold is exchanged for russet brown and grey, and the cycle of harmony closes again in winter."

These quotations are sufficient to point out to the student the great value which the study of the varied phases of nature in water-colour drawing and sketching may afterwards prove, when coloured decoration is taken up.

170. Mr. Crace is of opinion that the study of coloured decoration in the works of the great masters should precede water-colour drawing, and doubtless he is right, if the immediate practical application of what the student has learnt from nature is intended. The study of colour decoration, however, is one which is rarely commenced by architectural students till late in their career: perhaps five or six years after they have entered an office. During all this time they have neglected to train the eye to harmonies of colour, and that is why we are inclined more especially to insist on the great importance of sketching in water-colour from nature, as a variation to other work, on the first sketching tour they may take. To say to what point an architect is justified in carrying his drawing, depends on the subject. A study of an important building, in which colour forms the chief element of its beauty, as in one of the Venetian palaces, St. Mark's at Venice, Giotto's tower at Florence, or a portion of the interior of the church at Assisi, may claim long expenditure of time, because these subjects are worth it, and art as well as nature (or the effect produced by age) have contributed to their beauty. Whether the same labour should be bestowed on the ruins of an abbey, the colour on which now is due chiefly to the effects of time, and was not one of the qualities originally contemplated in its design and execution, is an open question, which must be left to the student, and depends on the amount of pleasure he derives from such work.

171. The continued practice of making *careful water-colour drawings* gives to some a power of making *sketches in colour* which may take only two or three hours, and sometimes if the student tries to place on record what he sees, without any idea of making a show drawing, it will do him more good than making a highly finished work. The sketching of landscape is purely a matter of sentiment; when done during the vacation it may be looked upon as holiday recreation, and if it has enabled the student to pass a pleasant hour or two and added a memento to his collection, no great loss of time has been incurred, there being always the possible chance of its having added some additional knowledge to his use of the brush and training of the eye.*

172. Some students are accustomed to fix their pencil sketches by a slight wash of

* See Plate 25, from a drawing by the late Mr. Fred. P. Cockerell; in this case the shadows were tinted in sepia, and Chinese white has been used to suggest the plastered portions of wall.

PIAZZA DELL' ANNUNZIATA, FLORENCE.

The late Frederick Peppys Cockerell.

water-colour, which, whilst preventing the rubbing of the pencil lines, suggests the relative colours of the object drawn. It is not necessary that the colours indicated should be of the full strength, for this would destroy the value of the pencil lines, which would become invisible under a strong wash; this system, however, leads the way to water-colour drawing, gradually accustoming the student to the use of the brush and recognition of effects in colour.

173. For variety of work, the use of some of the hand-made tinted papers, with the shadows indicated in monochrome tints, and the high lights brought out with Chinese white, will produce results more in keeping with the actual effect of the building than sketches which are only in pencil. Drawings of ornament made in indelible brown ink on grey tinted paper, and the lights brought out in Chinese white, constitute another variety of work.*

Section E.—COLOUR DECORATION.

174. The study of colour decoration has lately occupied the attention of some of the students of the Architectural Association, and a class specially devoted to the subject was started some six or seven years ago; the establishment of a Travelling Studentship for its special study by the Royal Institute of British Architects, with funds left for that purpose by the executors of the late Mr. Owen Jones, will probably induce a number of students to devote themselves a little more to this subject, and to include amongst their other work that of making some record of the principles of the use of colour as applied to ancient buildings; we say principles, because a great deal more may be done than simply copying one or two examples; a careful study of a portion of wall decoration (such as is found at Pompeii, for instance) may take several days to make, and will be only one of many examples. It should be supplemented therefore afterwards by notes of others, showing the variations which can be obtained by the use of other grounds of colour, and by general observation of the principles which are to be observed when such variations occur.

175. In this respect a method adopted by Mr. H. W. Lonsdale, when making his tour as Travelling Student of the Royal Academy, is well worthy of record. Having designed a group of three or four draped figures, he had them reproduced by lithography and a number of copies struck off, which he took with him. When in any church or public building in Italy, either in the stained glass or wall decoration, he noticed any distinct scheme, either in the design of the ornament or the contrasts or harmonies of colour, he made a study in colour, introducing the figures as the chief key.

176. This method of work goes far beyond the ordinary custom of simply copying,

* A water-colour class was started under the auspices of the Architectural Association in 1868, the late Mr. Aaron Penley having undertaken to instruct the class; after his death it was revived under Mr. Paul Naftel, and subsequently directed by Mr. Sutton Palmer and Mr. Weedon. The class is held during the summer, there being six indoor and six outdoor lessons; in the former, studies in colour are lent to the students to copy; the latter are given on Saturday afternoons at various picturesque places near London. To those who desire to acquire some knowledge of this branch of art, such a class as this is invaluable.

and there are not many architectural students who could undertake such a work on the spot; as a rule, they would content themselves with making copies of what they saw, trusting in after life with their drawings to adapt the colouring to some design of their own. Just, however, as many artists when working from nature will (under her direct influence) produce much finer work, although they group and arrange their subjects, so Mr. Lonsdale felt he was able to adapt his design better under the immediate inspiration of the painting before him than if he had deferred his adaptation till a later period, when he would only have had his drawings before him.*

177. There are occasions when it is not convenient or when there is not sufficient time to take out the colour-box; in such cases a few coloured chalk pencils will then be found useful to suggest the colours; the use of chalk does not always give the actual effect, but it records a colour better than a note in pencil.

178. It would not be possible to enter further into the subject here, but we would refer the reader to the paper read by Mr. J. D. Crace before the Architectural Association in June, 1874 (published in the professional journals of that date), quoting some of the leading maxims which he laid down to guide the decorator in his application of colours or tints in buildings.

1. "The colour must be so used as best to express the best forms and proportions of the structure to which it is applied.

2. "It must also be so used to assist the eye in recognising the structural features of the building where such exist. Or, in the absence of such features architecturally, to compensate for their absence by some satisfactory substitute of division and arrangement.

3. "Where a room or building is obviously defective in proportion (at any rate for its intended purpose), colour may be so used as to assist the sense of proportion, and to some extent to correct the existing defect.

4. "Whichever of these purposes the colourist has chiefly in view, he must, above all, take care that his colours are harmonised with each other, and that his ornament, in whatever style, assists his purpose."

Section F.—RUBBING OF BRASSES, ETC.

179. Though rarely undertaken at the present day (so varied are the occupations of the architectural student during his sketching tours), the custom of rubbing brasses is one which ought not to be passed over in this work. The fertility of design in ornament, the admirable conventional drawing of the folds in the drapery, and the wealth of record of ancient costumes and heraldry which are to be found in the brasses of the late mediæval periods, will abundantly repay the student who may elect to take up this class of work. Its practical application has been revived of late, and therefore either for the design of modern brasses, or even for the adaptation of the figures and

* There is a distinct principle in this method of work, *i.e.*, that of trying on the spot to evolve something more than is actually seen in an ancient building, which it is worth while noting; the late Mr. E. W. Godwin was accustomed occasionally when drawing from ancient buildings to alter features of which he did not entirely approve (noting his alterations); in other words, he attempted to originate a treatment of his own, inspiring himself with the work before him. Willars de Honecourt, the mediæval architect, adopted the same principle in his sketch-book, as also the late Mr. Burges in his vellum album.

ornament to drawings for stained glass, a collection of a few examples will be invaluable.

180. In their production, ordinary white lining paper and heel-ball * are used. The lining paper is laid down on the brass, being kept in its place by lead weights,† and the heel-ball is rubbed over the brass. There are two qualities of heel-ball, *hard* and *soft;* the former is generally recommended for elaborate details, the latter yields a magnificent black rubbing. The result of the rubbing is what, photographically, would be called "a negative," that is to say, the hollows come out white; the original surface of the brass not engraved, black. The general effect of the rubbing is improved, if the large unengraved spaces round the figure and the ornament are left white. In order to do this, and to keep the borders clean, pieces of lining paper should be cut to the shape and laid on the margin of the figures and ornament whilst rubbing. To keep the hollows white on the figure or ornament, the lining paper should be pressed into them by the hand before rubbing with the heel-ball. When brasses are fixed vertically against a wall, wafers may be used to fix up the lining paper and keep it in position; if the brasses be large, it is better to make the rubbing on separate pieces of paper and mount them afterwards.

181. Any defects in the original rubbing can be made good afterwards by taking fresh rubbings of the imperfect parts and mounting them on it; and defects in the brass itself, such as worn places or holes, should be stippled up with lampblack. If any armorial bearings with coloured enamels exist on the brasses, other pieces of paper should be cut out to the shape, and coloured and mounted afterwards. The colours in the letters can also be laid on the rubbing without detracting from the effect of the brass.

182. The same materials (lining paper and heel-ball) may be used with advantage in obtaining rubbings of tracery, geometrical patterns, or flat ornament of any kind, to be afterwards made use of in correcting the measured drawings when they are set out.

CONCLUSION.

183. In conclusion we have only to add, that all drawings which the student makes should be capable of being arranged and re-arranged from time to time as his knowledge of his requirements becomes clearer to him. It is, therefore, always a mistake to draw on both sides of the paper, because it may eventually be found an

* A composition of beeswax, tallow, and lampblack, which can be obtained at any shoemaker's, the best quality, however, being obtainable at Ullathorne's, Gate Street, Lincoln's Inn Fields, and made by him specially for the purpose.

† For convenience of carrying, pieces of 8 lb. lead 4″ by 2″ should be used.

advantage to be able to divide the collection of the drawings; by classing them under their destination, if they be plans; their style or period, if they consist of elevations or perspective views; and their subjects, if they be special features, as doorways, windows, balconies, ceilings, fountains, etc. Studies of detail of carving, of coloured decoration, of brickwork, woodwork, or metal-work, may all eventually be more useful if they can be separately classed, so that the student has not to search through twenty note-books or many folios of drawings in order to find the special subject he is in want of. Finally, the student when drawing should always have some special object in view beyond making a drawing; no time should be spared in delineating any form in detail that is new to him, and if beyond a mere collection of notes and drawings he has been able to develop an enthusiasm for the noble profession in which he is engaged, the holidays he has devoted to his outdoor work will, in after years, be looked back to with pleasure and delight, whilst it is to be hoped his labours will not have been entirely thrown away, but will have laid the foundation of a successful professional career.

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